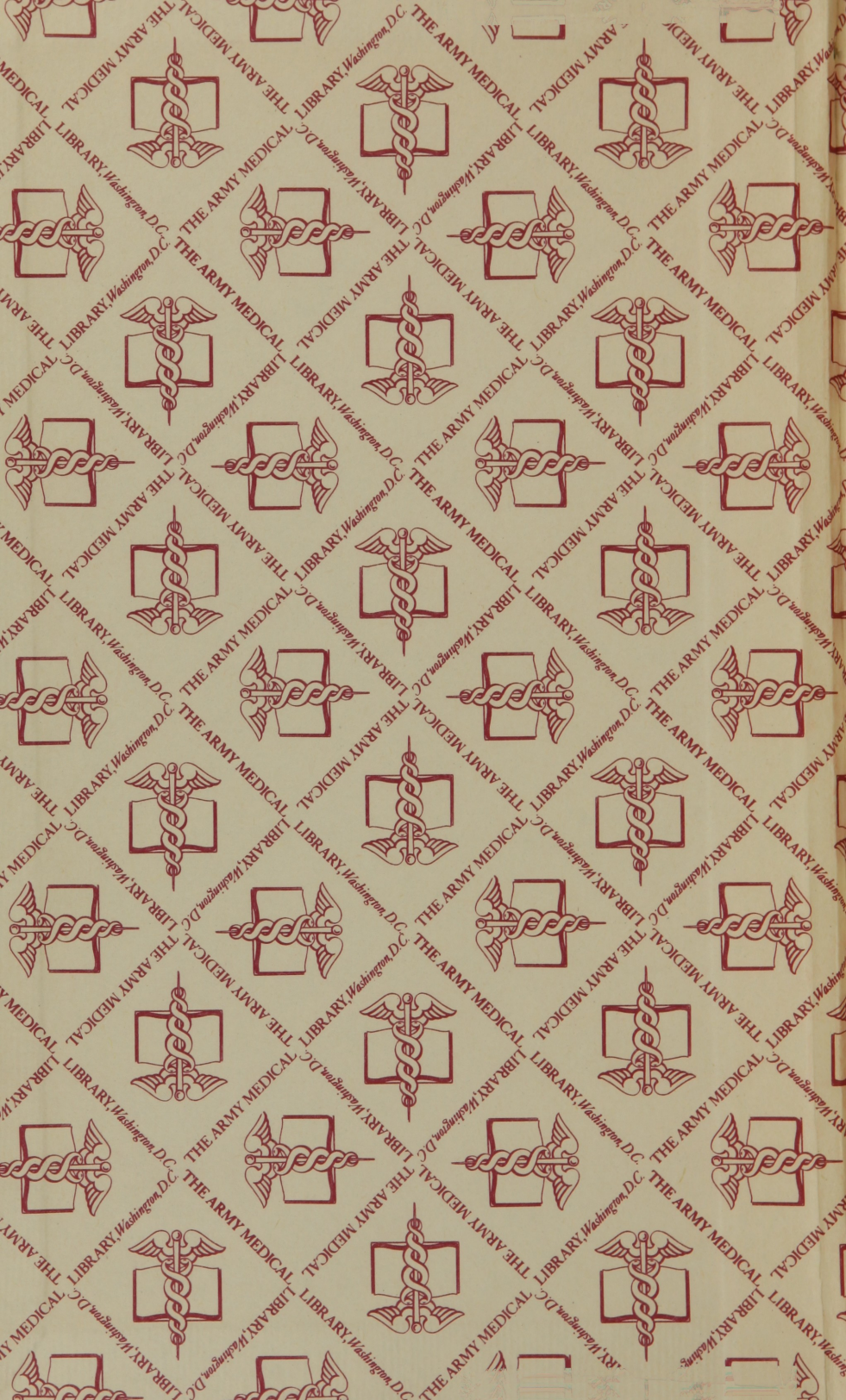
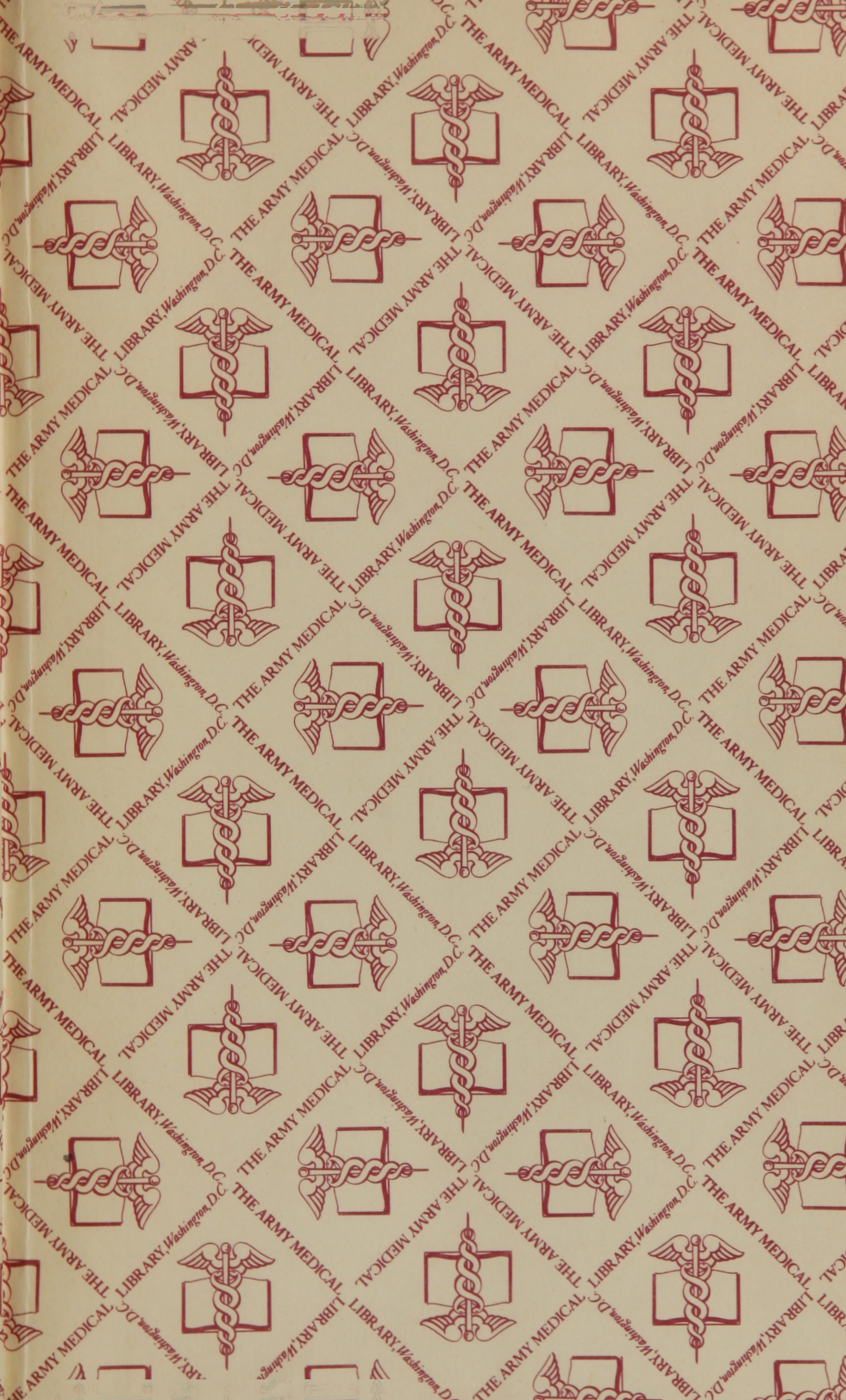


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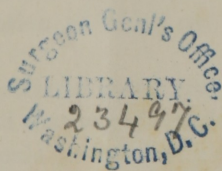


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AN INQUIRY  
INTO THE  
NATURE OF TYPHOIDAL FEVERS.

BASED UPON A CONSIDERATION OF  
THEIR HISTORY AND PATHOLOGY.

BY  
HENRY F. CAMPBELL, M.D.



PRESENTED TO THE AMERICAN MEDICAL ASSOCIATION,  
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# AN INQUIRY

## INTO THE

### NATURE OF TYPHOIDAL FEVERS.

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AN analysis of the symptoms of typhoid fever, with a view to its correct pathology, is embarrassed by the difficulty which presents itself in the selection of those phenomena and events which are really characteristic of the disease; for in the immense body of recorded observations with which the investigator is presented, there are comparatively but few which belong essentially to typhoid fever. In the following paper, it has been our object to give a brief but careful summary of its most prominent features, illustrating them when necessary by cases from the latest and most approved authorities, from a consideration of which our deductions have been made.

We have in no instance referred to our own observations of cases, for it is obvious to our mind that any views of disease founded mainly upon rational induction, would be less liable to fallacy, when based on the recorded, careful observations of others, than when they are merely the interpretation of our own cases, always liable to preconceived opinions and foregone conclusions, which have ever proved most effectual and deplorable barriers to correct observation. It is true that, in the plan here adopted, the same objection to a great extent will be found to exist; but by this method we are freed from the fallacies which would be apt to arise from a personal record, with a view to establish a doctrine, and will have to contend only with those which must necessarily attach to the interpretation of data, the record of which has in many instances been intended to corroborate views entirely dissimilar and often opposed to our own.



Typhoid fever has prevailed so widely and oftentimes with such great fatality that there are few diseases which have excited such general interest with the etiologist and pathologist. Its symptoms and phenomena have been repeatedly noted with the utmost accuracy, and the recorder of the present day must bound his aspirations, and be content, by simply *verifying* the observations of those who have preceded him. But with the analyst the case is far different; being in search of no new phenomenon, not professing to add anything to what are already cognate facts, in relation to the disease, his object being merely to interpret these facts from data founded upon them, repeated observation and record by others but strengthen and confirm his positions, and afford him a wider field and more abundant material from which to draw his conclusions.

HISTORY.—There are certain traits upon which nearly all writers have agreed as being usually characteristic of typhoid fever. In the first place there is always more or less prostration, with an impairment of the functions of the nervous system. Secondly, there is *fever*, which is continuous, but sometimes variable in its degree. Thirdly, in the vast majority of cases there is more or less diarrhœa, generally of an obstinate but passive character; and fourthly, its most constant pathological appearances have been found to be those which refer to the abdominal viscera, there being very uniformly some special alteration in the follicles studding principally the mucous membrane of the mesenteric portion of the intestinal canal known as the glands of Peyer and Brunner.

In addition to the above, which may be considered as almost essential characteristics of the disease, there are a great variety of symptoms described by almost every author as very constantly attendant upon it, and by many considered among its essential attributes. These, although very numerous, will be found generally more or less referable to one or other of three classes of symptoms, the combination of which appears to constitute the disease, viz. disturbances of the *nervous system*, of the *circulation*, and of the *digestive organs*—and so far as practicable, we will thus classify them in our summary. The symptoms pertaining to the *cerebro spinal system*, commonly denominated the nervous symptoms of typhoid fever, consist in wandering pains in various parts of the body; cephalalgia, pain in the back, loins, and extremities, more or less delirium, vigilance, somnolence, dulness of hearing, impaired vision, soreness of the mus-

cles, and occasionally subsultus tendinum, together with prostration of muscular power.

In relation to this class of symptoms our reference to statistics has been attended with various results; we find that they have generally been noted with a view to institute comparisons between the two types, typhoid and typhus, and the general result in regard to them, so far as we have been able to notice, has been; that nervous symptoms of one or other character are present in a large proportion of *typhoid* cases, but they do not generally form such prominent features in this as in the typhus type, where their existence is almost invariable, and of a character much more alarming; so that, of the two diseases, the common term "*nervous fever*" would be more applicable to typhus.

DISTURBANCES OF THE CIRCULATION are perhaps the most invariably present of the three classes of symptoms. Of these, we will notice the abnormal states of the pulse, abnormal temperature of the skin, and the capillary congestions frequently observed on the surface of the body.

The *pulse* is almost invariably more or less accelerated in both typhoid and typhus fever. In character, it is irritable, weak, and nervous, showing a remarkable contrast to the full, open, *sthenic* pulse, characterizing the paroxysms of periodic fever. Its frequency is far less than in the latter case, but it is nearly uniform; and although occasionally subject to variations, this general feature of unintermitting continuousness is so constant, that it is from this probably more than from any other feature that these types have acquired the general name of *continued fever*. The average mean of the pulse, according to the accurate observations of Dr. Flint, is  $95.\frac{7}{13}$  in typhoid cases, while it was found by him to be  $105.\frac{4}{3}$  in the typhus type, which I think will be found not to vary materially from the observations of others. His tables also show that irregularity and feebleness are much more common in typhus than in typhoid fever.

In relation to frequency he remarks: "There can be no doubt, if the pulse exceeds 120, except for a transient period, that the case is of dangerous severity; and the danger increases in more than geometrical ratio, if it rises above this point."

TEMPERATURE OF SURFACE.—There is, as in other forms of fever, more or less heat of surface, in continued fever, which varies from a



little above the natural warmth to what is known technically as biting heat, *calor mordax* ; but these aberrations are so common in every form of fever, that we cannot attach much importance to them in a pathological inquiry like the present.

SWEATING AND MOISTURE, we find more common in typhoid than in typhus fever. In the former, cases vary much in regard to these symptoms; sometimes the skin will remain usually dry, having at intervals sudden profuse exudations of sweat, soon becoming dry again. In other cases, the surface will be kept in a soft and gentle moisture during the whole disease; while, again, the most profuse colliquative sweats will shrivel the surface and rapidly exhaust the strength of the patient. Upon the whole, there is a greater tendency to moisture than to dryness of surface in typhoid fever; while in the typhus type, decidedly the reverse is found to obtain.

"It would be interesting," says Dr. Flint, "to ascertain upon what ulterior conditions sweating is dependent. With reference to this point of inquiry, it would be important to establish any relations subsisting between this event and other phenomena belonging to the natural history of the disease. I have examined the histories of several of the cases characterized by sweating, in order to discover a clue to some connection of this kind, but without success. It occurs not only at different periods of the disease, but apparently irrespective of the circulation, the temperature of the skin, and other symptoms. The antecedent morbid condition or conditions upon which it depends, and the circumstances involved in its production are unknown. All that can be said of its causation is, that it is an event incident to the progress of continued fever, belonging in the category with other incidental events, such as acceleration of the pulse, coating of the tongue, somnolency, &c., all of which are not more rationally explicable than it."

CAPILLARY CONGESTIONS.—Among the ordinary appearances of continued fever, there is no one which will strike the attention of the clinical observer more forcibly than the peculiar, diffused congestions on various parts of the cutaneous surface; and though the symptom is easily recalled to our minds by a bare mention of it, yet strange to say, it has been almost uniformly omitted by reporters until quite recently. Even Louis, with all his vigilance, seems to have allowed

this symptom to escape his attention. Dr. Gerhard, of Philadelphia, appears to have made the earliest and most distinct reference to it, in his account of the epidemic typhus fever, in Philadelphia, in 1836. Published in the *American Journal of Medical Sciences*, and also in *Graves's and Gerhard's Clinical Medicine*.

"A constant symptom," says Dr. G., "observed in every case of typhus fever, was a dull livid red hue of countenance, extending nearly over its whole surface. Sometimes this colour approached a purple. It coincided with a strong, dark red suffusion of the capillary vessels of the conjunctiva, which appeared at the same time with it; but it usually disappeared at an earlier stage than the injection of the eyes. The *conjunctiva* never presented the bright tinge or the brilliant aspect observed in acute inflammatory diseases of the brain, or eye itself."

Dr. William Jenner, of University College, London, has also given recently his observations on this subject, in his work on typhus and typhoid fever. He remarks: "The conjunctivæ were more or less intensely injected in twenty-five cases; and in all of those in which the opportunity occurred of observing the date of the first appearance of the increased vascularity, it began during the second week. \* \* \* In eleven of the cases the pupils were contracted. The expression was dull, and the bloodvessels had a dark red tinge, instead of their scarlet hue. The suffusion of the face and eyes was so constant and so well marked, in the fully formed disease, that it served almost as a pathognomonic sign. It was generally most evident in patients of a full habit of body. Towards the close of the disease, the leaden colour was gradually changed into a dull ashen tint, which remained until the entire recovery of the patient. The colour of the face when flushed (in typhus) was dusky red, and never pink as the cheeks were in cases of typhoid fever."

But it is to Dr. Austin Flint, to whose admirably accurate and faithful reports we have already referred, and upon which we must continue to draw for reliable data in this inquiry, that is due the credit of the fullest statistical account of this trait of the typhoid affection.

Inasmuch as we consider this symptom, as well as his observations in relation to it, somewhat important to the establishment of the views we have taken in regard to the pathology of the disease, we will give them somewhat *in extenso*. He remarks that these alterations of colour were evidently due to capillary congestion. They were always more marked on the cheeks than elsewhere, and



sometimes were chiefly observable in that situation. In many instances, they extended entirely over the body. He describes the redness of the face as resembling closely the appearance which the surface presents after exposure to cold, the explanation probably being the same in either instance, viz: "*retarded circulation of the blood in the capillary vessels.*"\* On pressure with the finger, the redness disappears, and returns when the pressure is removed. The redness returned less quickly in proportion to its lividity or duskiness, showing that the colour is an indication of the degree in which the forces of the circulation residing in the capillary system are depressed.

In the two types of continued fever, Dr. Flint found this symptom to differ very much; being much more frequent in the typhus type than in the typhoid, and also of a much darker and more livid hue in the former. In typhoid, it was seldom more than red, whereas in typhus, it was more frequently dusky or even livid than otherwise; showing that, whatever cause acted in its production, this cause existed in greater force in typhus than in typhoid fever.

"It may be suspected," remarks Dr. F., "that the capillary congestion of the face and surface generally, is dependent on the complication of pulmonary disease, in consequence of which, the free transmission of the blood through the lungs is prevented, and its aëration compromised. With reference to this point, I have compared the pulmonary symptoms with the symptoms now under consideration, in all the cases, and find that this connection does not uniformly exist. Several of the cases in which the congestive redness and dusky tint of the face was marked, presented pneumonic complication, denoted by cough and expectoration, accelerated respiration, and occasionally by the physical signs of inflammation of the lungs; but these symptoms and signs were absent in other cases in which the appearances of the face were the same; and the lungs evinced notable disorder and inflammation in cases in which no capillary congestion is recorded in the notes. To speak with greater exactness of the cases of typhus, congestive redness of the face and marked disturbance of the respiration were associated in nine cases. The congestive redness was present without notable disturbed respiration in two cases.

"Thus it appears that the condition of the capillaries is not attributable to the morbid condition of the lungs, or to derangement of the functional activity of these latter organs. It is worthy of note,

\* Austin Flint's First Report, p. 29.

however, that in typhus, in a large proportion of cases, capillary congestion is associated with pulmonary affection; while in typhoid the *absence* of such a connection appears to be the rule. It is highly probable that both pulmonary disorder and congestion of the surface, may be the effects of the same prior morbid condition. It is not likely that the capillary congestion in continued fever is limited to the surface when it is present in the latter situation. Internal parts, could they be observed, might be expected to present similar appearances. The lungs, as is well ascertained, are liable to become congested during the febrile career, and the form of pneumonitis which usually occurs as a complication of this fever, called pseudo pneumonitis, is usually supposed to result chiefly *from the passive engorgement* of these organs. This complication, however, is thought to be far more liable to occur in typhus than in typhoid fever. The morbid condition, then, whatever it may be, which determines the congestive redness of the skin is the occasion of congestions elsewhere. . . . In congestions pervading the capillary system of the general circulation, the lungs are especially prone to become involved. This is probably the fact in cases of typhoid as well as typhus, in which congestive redness of the surface is observed, but not in a degree sufficient, generally, to lead to a notable pulmonary complication or marked disorder of the respiration. The latter consequence, it would be expected, should much oftener be present in typhus, inasmuch as in this type, not only is capillary congestion present in a much larger number of cases, but it exists in a much greater degree."

CONJUNCTIVAL REDNESS.—Very nearly allied to capillary congestions of the general cutaneous surface of the body are those of the conjunctiva and other external mucous surfaces—and indeed by many they are classed with them, as occurring at the same time and apparently as a part of the same set of symptoms. Dr. Flint, however, has shown by his records that congestions and suffusions of the conjunctiva are by no means always associated with those of the general surface, but occur independent of them: "not only capillary congestion of the skin does not exist in all cases of congestive appearance of the conjunctiva, but the latter may be absent in cases in which the former is present." He farther remarks that this does not depend on cephalalgia. This, however, does not prove that they may not both be the effects of the same pathological condition—



*circumstances which we are not able to appreciate occasioning the manifestation of either exclusive of the other.*

After a careful estimate of his cases and their various features under comparison, Dr. Flint inquires what is probably the *prior condition* upon which these two congestions in common depend, or in other words, what is the common proximate cause? He considers that it depends upon the morbid condition of the blood itself; and does *not* relate to the state of the nervo-muscular forces influencing its circulation in the capillary vessels. In strict accordance with his excellent statistical method, he reasons thus from the fact, that if the cause resided in the vessels and not in the blood, inasmuch as the "pulse is the thermometer of the forces presiding over the general circulation," we should expect to find the circulatory forces compromised by the disease in proportion as the pulse was found feeble, weak, and irregular; but as his records have been attended with a different result, hence his conclusion varies from what would at first appear most rational. It will be our duty, a little later in this inquiry, to refer again to these views, and to endeavour to ascertain whether the present state of our knowledge of the physiology of the capillary circulation, will not relieve us from the necessity of regarding the condition of the heart's action as only the arbitrary criterion of the capillary circulation.

CUTANEOUS ERUPTIONS.—This class of symptoms being present in both the typhoid and typhus types of continued fevers, but under entirely different forms, it will be found convenient for the purposes of our analysis to institute a comparison of their prevailing characters in the two diseases. It will be found on reference to authors, that they very generally agree that in the majority of cases of typhoid fever, there is an eruption characterized by well-defined spots of a rose colour, varying in size from that of a pin-head to a quarter of an inch in diameter. Louis observed them in twenty-six out of thirty-six of his fatal cases,\* and Dr. Jackson's observations, in the Massachusetts General Hospital, have been attended with similar results, viz. about two-thirds of the cases presented the eruption.† Dr. Hale, as quoted by Dr. Bartlett, found the rose

\* Louis, *Researches on Typhoid Fever*.

† In passing, we would make the remark, though of course it has no bearing upon the object of this inquiry, that, according to our observations and those of many physicians with whom we have conferred in relation to the eruption of typhoid fever, in those cases which occur in the Southern and Middle States, even where the disease

spots in one hundred and seventy-seven out of one hundred and ninety-seven cases. Dr. Flint reports thirty-seven out of forty-eight cases in private and hospital practice. His description of the eruption is as follows: "It is generally limited to the chest and abdomen, but occasionally extends to the extremities. It may be copious, particularly over the chest and abdomen, but oftener it is the reverse, the spots being few in number. The eruption is of a rose-red colour (rose spots, *taches roses*), the spots are oval, appearing somewhat elevated. The redness momentarily disappearing on pressure."

In Dr. Jenner's description, we shall perhaps find all that is necessary to characterize this concomitant of typhoid fever: "The spots were slightly elevated. To detect the elevation, the finger had to be passed very delicately over the surface, as they had none of the hardness of the papulæ of lichen or of the first day's eruption of smallpox. Their apices were never acuminate, never flat, but invariably rounded, their bases gradually passing into the level of the surrounding cuticle. \* \* \* They were circular, and of a bright rose-colour, the latter fading insensibly into the natural hue of the skin around. They never possessed a well-defined margin. *They disappeared completely on pressure*, resuming their characteristic appearances as soon as the pressure was removed; and this was true from first to last, from their first eruption to their last trace. They left no stain of the cuticle behind; *they never passed into anything resembling petechiæ*; the characters they presented on their first appearance continued till they vanished. Their ordinary size was about a line in diameter, but occasionally they were not more than half a line, and sometimes a line and a half. The duration of each papule was three or four days; *fresh papulæ made their appearance every day or two*. Sometimes only one or two were present at first, ran through the whole course described, and then one or more fresh ones made their appearance and vanished in three or four days, and were followed by others to last as long. The number of papulæ seen at one time on the surface was ordinarily from six to twenty; though occasionally there was only one, and sometimes more than a hundred."

has prevailed as an epidemic, these eruptions are very rarely observable, although looked for with the utmost diligence throughout every stage of the disease. This absence of eruption in cases where every other symptom characteristic of typhoid fever was present, has been so uniform that many of our most intelligent practitioners have been disposed to doubt the diagnostic importance of eruptions in typhoid fever, and to look upon them as of accidental occurrence, not having any important connection with the true pathology of the disease.



"They usually occupied the abdomen, thorax, and back, but were occasionally present on the extremities. \* \* \* A very pale delicate scarlet tint of the skin sometimes preceded the eruption of the papulæ, but never lasted more than a day or two; the skin resembling in tint that of a person shortly after leaving a hot bath. Rose-spots occurred in nineteen of the twenty-three fatal cases here analyzed."\*

The typhus type of continued fever has been so uniformly characterized by cutaneous eruptions, that it is very often, even at the present day, classed among the eruptive fevers. Many of its synonyms indicate the frequency of this concomitant; viz., *exanthematic typhus*, *spotted fever*, *maculated fever*, *petechial fever*, &c., &c. And while, on the one hand, we find authors disagreeing in relation to the importance of an eruption in the typhoid type, they very uniformly, where the opportunities have been sufficient for extensive observation, agree as to the eruption of typhus being one of its pretty constant, indeed almost uniform, concomitants. Dr. Gerhard says: "It was present in thirty-two out of thirty-six whites. Of the four cases in which it was not visible, one died on the seventh day of the disease, and the others presented only slight symptoms of fever, which disappeared in four or five days. It was also visible, though less distinctly, in mulattoes, and we may infer that the colour of the skin alone prevented its appearance in the negroes."

In all of Dr. Jenner's fatal cases of typhus, forty-three in number, "*the mulberry-rash*," as he termed it, was present.

According to Dr. Bartlett, the eruption differs, in many respects, in a striking degree from that of typhoid fever. Its colour, especially after the second or third day of its appearance, is that of a duller or darker red. The spots are of a dun, dusky purplish hue; in some cases they become almost black. They vary in size from that of a minute point to a line, or even to an eighth of an inch. They are less regularly circular or oval than the rose-spots of typhoid fever. They are not elevated above the surrounding surface, and disappear but very partially, or not at all, on pressure. They are, almost always, much more numerous than the rose-spots of typhoid fever, *covering in many cases the entire trunk and extremities*. Sometimes they are spread almost as thickly as the eruption of measles.†

By Pringle, these spots are referred to in the following words:

\* Jenner on Typhoid and Typhus Fevers.

† Treatise on Fever, p. 220.

“There are certain spots which are the frequent, but not invariable attendants upon the fever in its worst state. They are of the *petechial* kind, of an obscure-red colour, paler than the measles, not raised above the skin, of no regular shape, but confluent. The nearer the spots approach the purple colour, the more ominous they are, though not absolutely mortal.” Dr. Stewart (as quoted by Dr. Bartlett) says the rash is permanent, and does not, like that of typhoid fever, come out in successive eruptions; that it, in all cases, presents the two periods of increase and decline, and that in the more severe cases it may exhibit, during the period of increase, four different states—*florid*, *dark*, *livid*, and *petechial*. When the hue of the eruption is florid, it readily disappears under pressure; when dark, it still disappears, but more slowly; when livid, semi-petechial, or pseudo-petechial, it is only partially effaced; and when petechial, it is not in the least affected by pressure. Dr. Henderson, of Edinburgh, has also noticed, that the progress and development of the eruption corresponded with the severity of the other symptoms of the disease, and that the decline of the eruption was nearly simultaneous with the first symptoms of convalescence; and, that the mortality and duration of the disease were in a very remarkable correspondence with the abundance of the eruption.

Dr. Jenner describes three stages, through which these spots pass from their commencement to their perfection—he calls them the mulberry-rash peculiar to typhus fever; says they are never papular; that each spot is slightly elevated, and of a dusky-pink colour, flattened on the surface, with no well-defined margin, but irregular in outline, and in this stage it disappears completely on pressure. Size, from a mere point to three or four lines in diameter. In two or three days they become darker and more dingy than on their first appearance, and now they only *fade* on pressure, but do not disappear. In the third stage they become dark purple, and remain unaltered by pressure, although their circumferences still fade. Sometimes they are changed into true petechiæ, or spots presenting the following characters: “A dusky crimson or purple colour, quite unaffected by pressure; a well-defined margin, and total want of elevation above the level of the cuticle.”

Dr. Clymer, in his work on fever, thus describes these spots:—

“Their resemblance to flea-bites is such, that on the one hand the latter are often mistaken for petechiæ, while on the other hand some physicians will insist that real petechiæ are nothing else but flea-bites. The two appearances, however, cannot be mistaken by a care-



ful observer, &c. Sometimes the petechiæ are few in number, and escape notice; in other instances, on the contrary, they are very much crowded. This appearance is owing to a *thin stratum of extravasation* on the surface of the true skin, and appears connected with increased force (?) of the circulating system, being most characteristic when reaction is high."

It will be observed that we have classed in our summary both the capillary congestions, and those of the surface, and the various eruptions incident to continued fever, under the common head of aberrations of the circulatory system; and although this has not been the order in which we have usually found them considered by authors, we have still retained it, inasmuch as we regard these two classes of phenomena as dependent upon causes very similar, if, indeed, not identical in their nature, viz.: Impairment of the nervous forces, from which the capillary system of the surface obtains its functional endowments. That the capillaries possess a nervous motive power, independent, and not in all cases correspondent with the heart's action, many facts both in experimental physiology and in pathology would go to corroborate. The exact nature and source of the nervous power are subjects foreign to the present part of our inquiry, and we therefore forbear here to discuss them.

On making a comparison of the cutaneous congestions and eruptions occurring in these two forms of continued fever, the following seems to be the result of our analysis of the foregoing summary of the observations and opinions of our best authors:—

*Firstly.* That both capillary congestions and eruptions of one or other kind are present on the cutaneous surface in the vast majority of the cases in both the typhoid and typhus type of continued fever.

*Secondly.* That these phenomena are more characteristic of typhus than of typhoid fever.

*Thirdly.* That those of typhoid fever are of a less serious character—more nearly resembling the healthy action of the capillaries than those of typhus, as evinced in the *congestions*, by the more florid and natural colour of the surface; showing that the blood, although circulating abnormally, still retains nearly its proper amount of oxygen—*i. e.* its retardation is not so great as in the typhus type, when the congested surface is "dark," "purple," "livid," and "dusky," "*resembling in appearance the cutaneous surface when its circulation is retarded from exposure to cold.*"\* In the eruptions,

\* Dr. Flint's First Report on Continued Fever.

the same kind of attributes indicate that the aberration is of a less serious nature in typhoid than in typhus—the spots are very few in number, and often absent altogether, very rarely extending to the extremities; they are simply of a reddish or pink colour, which readily disappears on pressure, returning when the pressure is removed; while in typhus fever they are very numerous, generally appearing on the extremities as well as on the body; they not only arrive at the stage of simple congestion, but they go beyond that point, do not yield to pressure, and, finally, after a continuance of some days they become true *petechiæ*,\* regular hemorrhagic spots, evidencing extravasation,† and, of course, a certain degree of disorganization in the vessels.‡ Again—If we look at the character of the two eruptions in another light, the same opinion of their relative gravity must obtain; the typhoid papula is an *elevated* object on the surface of the skin—the elevation is the result of an elimination *from the blood*, caused by a *kind of inflammation*, which is always a phenomenon occurring under vital influences: this pseudo-inflammatory process subsides by effusion, and one crop of papulæ is succeeded by another, which observes the same course, till the recovery or death of the patient; but in the typhous petechiæ these phenomena are absent, or, at least, only present on the first or second day, for they soon give place to others which are the evidence of more serious obstruction, and which are of such a character that their occurrence does not necessarily imply vitality in the parts wherein they occur. Thus we may say that, in *typhoid* fever, the redness of surface generally, and the eruption, may be termed true *congestion*, while the

\* Dr. Stewart, as quoted by Dr. Bartlett. Also Jenner, on Typhoid and Typhus Fevers.

† Clymer on Fever.

‡ On this subject we find Vogel expressing himself, in his section on the various forms of hyperæmia, in the following satisfactory manner:—

“In typhus, petechial, and putrid fever, &c., the extravasation of true blood is very frequent, *but is always dependent on laceration* of the vessels; and in producing this laceration, a change in the composition of the blood can only act a very secondary part. It can only act through a series of means, by favouring congestion and stagnation of the blood.” And in another place he says: “Extravasated blood always proceeds from the vessels, and results from their laceration. The view that, at least some of these effusions of blood may occur without any injury of the vessels, by a mere transudation of the blood through the attenuated vascular walls (diapedesis), is altogether untenable, although some even of our recent authors (Carswell among others) still support it. The walls of the bloodvessels—even of the smallest capillaries—are so impervious, that it is impossible for such large particles as the blood-corpuscles to pass through them in an uninjured condition.”—*Path. Anatomy*, p. 93.



livid-purple tint, as well as the maculæ of *typhus*, are as plainly the result of true *stasis*.”\*

**DISTURBANCES OF THE DIGESTIVE ORGANS.**—Under this head could be classed many of the symptoms characterizing typhoid fever. In the earlier part of the disease there is often loss of appetite, thirst, nausea and vomiting, together with a great variety of other symptoms, indicating a disordered condition of the nutritive apparatus; but the symptom which it is our object here more particularly to dwell upon, and the one which has been admitted by all to constitute an important part of the disease, if not the disease itself, is diarrhœa.

Louis reports it as present in all but three of his fatal cases; and in relation to the time of its commencement, his statistics show that out of forty fatal cases, from which he was able to obtain information on this point, twenty-two had somewhat frequent and liquid dejections on the first day of the disease. And in all the cases which died, lesions of the small intestine were the only constant pathological appearances, and these were always the first, so far as was appreciable, to commence. In favourable cases, the diarrhœa is sometimes absent, or makes its appearance quite late. There also appears to be a marked correspondence between the severity of the disease and the prominence of diarrhœa in any given case. Thus, in the eighty-eight favourable cases given by Louis, fifty-seven were found to experience severe symptoms, and thirty-one, slight ones; out of the fifty-seven

\* Vogel, again, is very plain on the above point, as well as in reference to the source from which these vessels derive their energy. His remarks express well what we would indicate in relation to these two states of the capillaries. “In many cases capillary hyperæmia is undoubtedly dependent on the nervous system; this, from whatever cause it is induced, gives rise to dilatation of the capillaries, and relaxation of their walls; the dilated capillaries receive, on purely mechanical grounds, more blood than they previously did; and a capillary which in its normal condition could admit of the passage of only a single row of corpuscles, may now admit of two or three. At the same time an excess of plasma escapes through the attenuated walls of the capillaries. [Hence the papulæ of typhoid fever are elevated by this plasma.] The part affected contains an excess of blood-corpuscles, and hence appears reddened. This is the condition which is known in pathology as *congestion*—it frequently occurs in the living body in external parts, as in the face, the eye, or the skin. \* \* \* As that form of capillary hyperæmia in which there is no stagnation of the corpuscles is termed *congestion*, so the *higher degree* (where they *stagnate*, and the local circulation is arrested) is termed *stasis*.” In the same place he also indicates it as his opinion, that this passive or hypostatic hyperæmia is the result of nervous depression. Who could ask a more exact portraiture than the above, of the cutaneous phenomena in the two types of continued fever?

subjects who had more or less severe symptoms, twenty-four had diarrhoea from the commencement of the disease, which will be found to be a somewhat smaller proportion than obtained in his fatal cases. Among the other patients, five had it on the second day, three on the third, four on the fourth, &c. &c.; in two cases, it appeared as late as the 18th and 30th days, but these were very mild cases, the only symptom of the disease being loss of appetite, weariness, loss of strength, &c., which continued for twenty-five days in one of the cases; indeed, we can hardly regard these as cases of typhoid fever, until after the supervention of the diarrhoea.

The length of its duration is variously reported by authors; the sum of Louis's severe cases would show an average of about four weeks, which, perhaps, would be found in any estimate made from so large a number of cases, to be about its ordinary duration. The reports of most writers favour the opinion that its duration is equal to that of the disease itself, beginning with its access, and generally continuing in a more or less degree till after convalescence is fairly and fully established.

The number of the discharges will be found to vary from one or two to twenty or thirty a day; and a cause of great discrepancy in reports of the disease in relation to this symptom, has been that many authors do not regard liquid but infrequent stools as cases of diarrhoea; while others, among whom is Louis, regard all cases, wherein the *thin* passages are found, as presenting the complication of this symptom. We do not think it necessary here to argue which mode of estimating is proper, but for our purposes, the plan of determining by the *quality*, rather than by the *number* of the discharges being most available, we have considered all, as cases with diarrhoea, whenever the discharges were of a liquid character, independent of the action of cathartics. Inasmuch, as our pathology of the disease is more plainly indicated by the aberration in the secretion, than by any other circumstance in this connection, we have considered this pathological condition more or less present, whenever this aberration has been found to exist, and in this view, we are corroborated by the observations of all our best and most philosophic observers, Bretonneau, Chomel, Louis, Bartlett, Jenner, and Flint; and, indeed, every fact in regard to this subject corroborates the opinion, that it is the character of the stools rather than their frequency, which marks the existence of intestinal lesion in typhoid fever.

The stools are generally of a liquid character, of a yellowish or dark-brown colour, more resembling, according to Dr. Bartlett, new



cider, than anything else. Louis speaks of them as being like coffee-grounds; perhaps the best description we can give, is that they resemble muddy coffee, more nearly than any other liquid. All authors seem agreed that they in general contain but little or no mucus, and but seldom resemble in character the discharges found in ordinary diarrhœa, and that they are seldom complicated with those of a dysenteric character. Their odour is fetid, though not invariably so. There is frequently more or less blood found mixed with the passages. In two cases reported by Louis (Obs. 18 and 44), the blood was pure and fresh; in the majority, it presented the appearance of being coagulated, and gave to the evacuations the appearance and consistence of coffee-grounds, which he says is very remarkable, inasmuch as evacuations of this nature were seldom if ever observed in the course of acute diseases, other than the typhoid affection, and because, when we may be in doubt as to the nature of any disease, their existence will contribute very much to make the diagnosis more clear and satisfactory.\*

*Pain in the Abdomen.*—In connection with the diarrhœa, abdominal pain is found to be a very common attendant on typhoid fever. It occurs most frequently in the right iliac fossa, in the hypogastric and umbilical regions, and is generally in direct relation in its severity to that of the diarrhœa. It is oftener of a dull aching character than otherwise, and sometimes there is only a slight soreness on pressure. These pains and their relations to the lesion of the intestinal canal, have been very fully considered by M. Louis, who thinks that they indicate a diseased condition of the mucous membrane of the small intestine with scarcely less certainty than does the diarrhœa itself. In a great number of his patients, these pains began before the diarrhœa, often on the first day of the access of disease; and though they were generally very shortly succeeded by diarrhœa, yet not invariably, nor should we necessarily expect them to be, inasmuch as we know full well that in true enteritis, diarrhœa does not uniformly occur on the first day, although the seat of the inflammation is in one or other of the intestines.† Dr. Bartlett describes them as continuing frequently through the whole course of the fever, and as being often the only cause of distress to the patient.

*Meteorism or tympanites*, is an intestinal symptom, to which M. Louis and most authors attach the greatest importance. The flatulent distension of the abdominal parietes was found by him to occur

\* Louis. Part III. page 18.

† M. Louis. Part III. Chap. 1.

in thirty-four out of forty-six cases of the disease. It was variable in its time of coming on; sometimes within a few days of the attack, but generally much later. By a few writers, in which number is Dr. Hale,\* of Boston, it is reported as occurring most frequently quite early, but Dr. Bartlett says this is entirely opposed to his own observation and the experience of many of the best authorities.

"It varies in degree," says Dr. B., "from a slight rigidity of the muscles and straightness of the parietes to the extremest distension; in such cases occasioning, by its mechanical action on the lungs, no inconsiderable degree of dyspnœa. It generally persists after its first appearance till the fatal termination, or the approach of convalescence; although it is not usual for it to vary considerably in degree, at different periods of the fever. The flatus rarely passes off per anum, and seems to be but little disturbed by the peristaltic motion of the intestines."†

In relation to its diagnostic value M. Louis remarks: "In the same proportion that meteorism was frequent in individuals attacked with typhoid fever, so it was rarely observed in the course of other acute diseases. Out of eighty subjects, the greater part of whom had diarrhœa, six only had meteorism; four pneumonic patients out of fifty-six had some meteorism during three or four days also; but only two out of forty-six attacked with eruptive diseases, had any meteorism." He did not meet with this symptom in other acute diseases, even in any one of the eighty-six cases of enteritis, properly so called, whether more or less severe. In speaking of the cause of this complication, M. Louis says: "Although in the actual state of our science, I cannot assign any cause for meteorism, I would, nevertheless remark, that it seemed to me to follow a law which was analogous to that by which other symptoms were governed; since, as in those attacked with the typhoid affection, its frequency and force were proportionate to the degree of severity of the principal disease; and among the others, those alone had it in whom the febrile excitement was the most marked; at least such was commonly the case."‡

**PATHOLOGICAL LESIONS.**—For the description of the anatomical lesions of typhoid fever, various plans and classifications have been devised; but as, in the present inquiry, it is indifferent as to the result what mode we adopt, we have chosen that which seemed most con-

\* Medical Communications, Massachusetts Medical Society, 1839.

† Essay on Fevers, page 76.

‡ Louis. Part III. page 36.



venient, and which would place those particular changes from which we deduce our views of the pathology of the disease in the most distinct relation with the other data under consideration. Many of the pathological changes observed in this disease are considered by authors as merely of an accidental or occasional nature; while others, from their frequency, indeed invariableness, have been regarded as the essential lesions of typhoid fever.

*The Brain and its Membranes* are seldom the seat of any very important lesion in this disease, which fact is very surprising when we consider the amount of functional derangement so constantly present. When these lesions exist, they are not of a character which shows any important relation to the phenomena of the disease, nor are they at all proportionate to the severity of the symptoms which pertain to disturbed functions in these organs. Chomel examined the brain and its membranes carefully in thirty-eight cases; there was no appreciable alteration whatever in fifteen cases. The other cases presented nothing very striking; serous effusions, more or less vascular injections in the membranes and brain itself being their chief characteristics.\* Dr. Flint, of Buffalo, has also made the report of a few cases wherein he has made careful examinations of these facts, but with results not materially varying from those of other authors; in no case was there any softening of the brain itself.† Louis examined forty-six cases. There was subarachnoid effusions in twenty-eight, vascularity and more or less injection in the remainder.

In relation to this class of lesions Dr. Bartlett remarks, "there is no ascertained relation between the cerebral symptoms during life and the pathological conditions of the brain and its membranes after death. Delirium and somnolence are found to have occurred as frequently, and to have been as strongly marked, in patients whose brains presented no changes, or exceedingly slight ones after death, as in those of an opposite character. Again, it is obvious that these lesions are in no way peculiar to typhoid fever, since they are found almost as frequently in patients dead from other acute diseases, excluding those of the brain itself and its envelops, as in those dead from fever."‡

*The Heart and Circulating Apparatus* were found altered in about half of Louis's cases, the alteration consisting in the substance of

\* Chomel, *Leçons de Clin. Med.* p. 294.

† First and Second Reports on Continued Fever.

‡ Treatise on Fevers, p. 90.

the heart being of a pale colour and soft flabby consistence. In seventeen of his cases (in number, forty-six) the softening was so well marked that the tissue could be readily broken down. This softening was generally accompanied with great flaccidity of the organ, though they would occasionally exist separately.\* These alterations, according to most authors, are accompanied by changes of colour, the substance of the heart becoming pale and sometimes of a livid or violet tinge. Dr. Jenner's examinations also corroborate the above, a good proportion of his cases presenting the same alterations.† The condition of the heart does not differ very materially in the two types of continued fever, it being found "flabby, soft, easily broken down in the typhus as in the typhoid variety." Here, perhaps, we can more appropriately than elsewhere notice the condition of the voluntary muscles, between which and the condition of the heart there is found a remarkable difference. We find no account elsewhere than in Louis's researches. He remarks: "I examined the muscles which govern the voluntary movements, in nearly all the subjects, and I found them nearly always natural with regard to colour and consistence; and this is the more remarkable, inasmuch, as I observed before, the *heart* was more or less seriously softened in a great number of cases. (Vol. i. p. 352.)

Louis describes the internal surface of the aorta as changed in colour in more than half of his cases. The alteration consisted in patches of morbid redness, sometimes very bright, and extending from the ascending aorta to its bifurcation, and even sometimes beyond it. The discoloration extended generally deeper than the lining membrane of the vessel, and was proportionate in its intensity of colour, and also in the amount to which the coats were involved, to the degree of flaccidity and softening of the heart.

Louis remarks in relation to this feature; that "the colour of the aorta has been particularly investigated of late by many distinguished physicians. Some have considered the red colour as simply the effect of *imbibition*, met with in violent deaths as well as in various diseases; others have regarded it as the result of inflammation on which depended a series of symptoms called inflammatory fever. But the facts we have just analyzed cannot, it seems to me, be accounted for under either of these hypotheses." He then asks: If it be simple imbibition, why is the aorta not discoloured in all

\* Louis's Researches on Typhoid Fever, vol. i. p. 331.

† Typhoid and Typhus Fever, p. 80.



cases where blood is found in its cavity? On the other hand, if it is inflammation, why did not these patients present symptoms different from those the aorta of which did not present these discolorations? He finally seems inclined to the opinion that it depends upon the imbibition of the blood, but that the special alteration which it has undergone in this disease is a necessary prerequisite to the imbibition.† The most rational explanation of the above appearance, to our mind, is that it is dependent upon the same condition of the small vessels supplying the walls of the aorta, the vasa vasorum, which operates in the minute cutaneous capillaries in the production of the spots and congestion on the cutaneous surface; for we know there are many diseases in which similar alterations of the blood occur as in typhus, and yet no such discoloration is observed in the aorta.†

*The Lungs* have been found very frequently presenting marked and peculiar alterations. Louis found them nearly natural in fifteen out of forty-six of his cases, which he says is the proportion in which he found them affected in other diseases, excluding of course those of the lungs themselves. Chomel reports ten in forty-two cases. Dr. Jenner says that “congestion is very frequent in those dead from typhoid fever, and rare in those from typhus fever.” He calls it the lobular non-granular consolidation of the lungs, which he thus describes: “Externally, a portion of lung in this condition has a mottled aspect; here and there patches, varying in size from a single lobule, to half or more of a lobe, of a deep bluish, chocolate, violet, or purplish slate colour, bounded by a well-defined angular margin, crossed, if it includes more than one or two lobules, and mapped out into smaller patches by dull opaque whitish lines. \* \* \* Scattered in the midst of the larger patches are frequently found one or more healthy lobules.” Dr. Flint describes this condition of the lungs as a sort of pseudo-pneumonitis, which probably results from the *passive* engorgement of the lungs, and seems to think it more frequent in typhus than in typhoid fever.

Dr. Bartlett says also, “that it is quite unlike, in almost every

\* Louis's Researches on Typhoid Fever, 291.

† Andral and Gavarret have made four analyses of the blood of three persons suffering from scarlatina, which indicate decidedly the existence of hypinosis. Lecanu has also made two analyses of the blood in this disease, and has obtained nearly similar results.—Simon, *Chemistry of Man*, p. 246. Hassall also places smallpox, scarlatina, and measles in the same category, and describes the character of the blood as nearly identical in all, in this respect.—*Microscopic Anatomy*, vol. i. p. 147.

respect, the secondary stage of inflammation, although the term hepatization has sometimes been applied to it. It is not indicated by any peculiar symptom during life, and he farther expresses the opinion that neither the symptoms nor the lesions go to show that the lungs play any very important part in the numerous and complicated phenomena of typhoid fever;”\* but from the comparative uniformity of their occurrence we are disposed to form a somewhat different opinion, and to think their frequency and character are such as to allow the deduction that the lungs, like many other viscera, are immediately under the reign of those morbid influences or conditions upon which the disease depends.

*The state of the blood* is very properly accounted as being among the anatomical changes, though examinations of this fluid are generally made previous to the death of the patient. From the numerous examinations of Andral and Gavarret, besides many others, the blood appears to exhibit the characters of hypinosis; one of the characteristics of which state is diminished fibrin; more frequently in typhoid and typhus fever than in almost any other disease. The blood in this disease, says Simon, is very deficient in fibrin, and frequently also in albumen. It coagulates imperfectly and often remains in a semifluid state, and when a clot is formed, it is soft and scarcely ever covered with a buffy coat. The character of the blood appears to be very much the same in the typhus as in the typhoid type of continued fever, as likewise are the pathological lesions referring to the heart. Blood more generally dark in the former. The state of the blood in the typhoid affection, however, is not uniform, for, as Simon remarks, it varies much at different times, which has been the cause of much discrepancy in the accounts of various authors; thus, in the stage of excitement, instead of having too little fibrin, it is often found to contain more than in the normal state, becoming then in the opposite condition of hyperinosis. From this it would appear that the state of the blood in the typhoid affection cannot be of the paramount significance that many authors would claim for it; for during the times that this fluid is presenting these very opposite chemical and physical attributes, the main characteristic phenomena of the disease do not appear to be at all altered in correspondence with them, and therefore must depend upon some other influence than the state of the blood for their continuance, otherwise they would be subject to interruptions. If they depend

\* Treatise on Fevers, p. 87.



upon hypnosis, reason would not tolerate the supposition that they remain unaffected during hypnosis.

**ABDOMINAL VISCERA.**—The changes which occur in these organs are by far the most important incident to the disease, and hence we have as one of its synonymes typhus abdominalis; indeed, if we except the weak and accelerated pulse and the altered condition of the heart and blood, nearly all the phenomena, both symptomatic and *post mortem*, may be said to refer to the abdominal viscera.

*The spleen*, with only four exceptions, was more or less seriously changed in all of Louis's cases. Its structure was ordinarily softened, sometimes thickened, and frequently four or five times larger than natural. Dr. Jenner says, "that it was enlarged in all his cases of typhoid fever; softened in one-third of the cases only." Dr. Bartlett reports it as more frequently enlarged in typhoid than in typhus fever.

*The liver* was softened in half of Louis's cases, in some to a remarkable degree. Dr. Jenner says that this again, together with the pancreas and kidneys, were more flabby in the cases of typhoid than of typhus fever. There was an ulceration in the lining membrane of the gall-bladder in one of fourteen cases of typhoid, and in nine of thirty-one cases of typhus; in the latter disease, the bile was much more thick and of a darker green colour than in the former disease. Dr. Bartlett adds, that this difference in the appearance of the bile in a large majority of cases is well marked in the two diseases.

*The urinary bladder* was found ulcerated in one of Louis's cases, and also in one of Dr. Jenner's cases of typhoid, but in no one of typhus fever.

Under the head of *Organs of Respiration*,\* Louis describes various changes in the epiglottis, glottis, larynx, and trachea; such as ulceration, red patches, &c. &c., and remarks, that with the exception of that of the trachea, all the mucous membranes were more or less thickened, reddened, softened, and a certain number of times *ulcerated*, in patients who died of typhoid fever.

*The pharynx and œsophagus*, in a large proportion of Louis's cases were found in a healthy condition, but there occurred with considerable frequency ulcerations of the mucous membranes of these parts; in the case of the pharynx, in a proportion of rather more than one-sixth of the cases. These ulcerations varied from one to

\* Louis, *Researches on Typhoid Fever*, vol. i. p. 294.

six or eight lines in diameter and were various in their contour; generally superficial. In relation to these changes, Louis remarks: "Ulcerations of the pharynx and œsophagus having occurred only in a small number of typhoid patients, and in no other disease, may be considered among the anatomical characteristics of the former; *though they are secondary*, these are very important characteristics, nevertheless, because it would be only necessary to find ulcerations in the pharynx or œsophagus in a patient who died of an acute disease in order to be almost sure of the nature of that disease."\*

Dr. Jenner found inflammation with or without ulceration of the larynx and pharynx present in about half his cases. His analysis leads him to the conclusion that the laryngeal inflammation is secondary to the pharyngeal, and that laryngitis, independent of pharyngitis is extremely unfrequent in typhoid fever.†

LESIONS OF THE ALIMENTARY CANAL.—Of all the anatomical changes pertaining to typhoid fever, there are none so peculiar and characteristic of the disease, none which are so plainly and unmistakably indicated by the symptoms during life as those which refer to the alimentary canal. So constantly do these lesions attend the peculiar phenomena which characterize typhoid fever, that at the present day, the one and the other set of facts are considered as invariably constituting essential parts of the disease, and in many instances these are the only characteristics which determine the positive existence of typhoid fever; so that these changes have become the terms by which the disease itself is indicated, as dothineritis, follicular enteritis, &c.

*The stomach* was found to present *post-mortem* changes in about two-thirds of Louis's cases. The alterations of which it was the seat consisted in changes of colour, consistence, and thickness. It was sometimes mamellonated, and four of his cases presented ulcerations; these ulcerations were small in size, superficial, and not very numerous. Chomel found various changes in the mucous membrane of the stomach, but was not able to discover ulcerations. Dr. Flint describes a remarkable and to us an important *post-mortem* fact as occurring in several of his cases, which we have not been able to observe in the reports of others. It is the presence of *ecchymoses*, of more or less extent, in the mucous membrane of the stomach. He

\* Researches on Typhoid Fever, vol. i. p. 383.

† Bartlett's Treatise on Fever, p. 91.



speaks of them as presenting "punctated redness, or ecchymoses," and expressly states that there was "no *capilliform* redness" in the cases where this appearance was observed. "The mucous membrane," he says, "was softened; several ulcerations, varying in size and form, the largest half an inch in length and three or four lines in width, superficial, apparently having penetrated only the mucous coat. These appearances were limited to the larger curvature. The organ at this part was easily torn, a rent occurring in removing it from its spinal attachments." In another case he again remarks, "the stomach, on its internal surface, presented *several patches of ecchymoses*."\*

Louis, who has paid great attention to the gastric pathological appearances, was not able to make out any very important relationship between them and the gastric symptoms previous to the death of patients in whom they existed. He observed that in many cases the lesions existed after death, where there had existed no gastric indications of their presence during life, and that distress in the epigastrium, with nausea and vomiting, often existed when the mucous membrane was found healthy. Chomel was alike unsuccessful in establishing any constant relationship between these two sets of phenomena. Flint makes a similar remark with regard to a few cases in which he made *post-mortem* examinations; thus, "in two fatal cases in which the stomach exhibited lesions, ulcerations in one of them, vomiting is not noted to have occurred."†

From this feature of non-correspondence between the symptoms of irritation in the stomach and the amount of gastric congestion and ulceration, together with the peculiar character of the congestions, as just noted from Dr. Flint, being of a hemorrhagic or ecchymosed character, we would reasonably infer that they are *passive* in their nature, and seldom dependent on nervous *irritation* of the stomach, but are the result of passive engorgement of the vessels; and, indeed, when closely considered, all the mucous congestions pertaining to typhoid fever, will be discovered to be markedly of this passive character, and but little or not at all productive of irritation. There is deficiency rather than excess of action in the vessels, and the nervous susceptibilities of the mucous surfaces appear to be unaccountably obtunded, to what would rationally be expected to act as causes of great irritation, such as ulcerations, thick-

\* First Report on Continued Fever, pp. 128-129.

† First Clinical Report, p. 79.

enings, &c.; as we have just seen that ulcerations exist in the stomach without vomiting, and in many cases of congestion elsewhere, as in those of the conjunctiva, when it did not increase the susceptibility of the eye to light.\* And again, in the cases of diarrhoea, the urgency of the evacuations was not very pressing, inasmuch as it was often necessary to call the attention of patients to the subject, by asking them if they did not desire to evacuate the bowels.† We never observe in the diarrhoea of typhoid fever anything like the tenesmus, so common in other forms of enteric disorder; and yet the amount of actual disease in the intestine is far greater than in many of them.

THE SMALL INTESTINE.—The characteristic lesion of typhoid fever, and, of course, by far the most interesting of all the anatomic changes observed in this disease, is found in the small intestine; its existence is invariable, and in many instances it is the only distinguishing trait of the disease. It consists of changes, varying in character, in the mucous follicles, known as the glands of Peyer, found along the mesenteric portion of the canal. The character of these alterations has been found to vary very much, in proportion to the duration of the disease and their distance from the ileo cæcal valve, where the follicles are uniformly the subject of more serious alterations than elsewhere. Louis found the elliptical patches of the ileum more or less seriously changed in structure in all the patients the report of whose cases he subjected to analysis. The region in which they were infected, varied from the last two to eight feet of the canal. They were affected throughout the whole length of the canal in one case only. His description of these changes is more extensive and minute than we consider necessary for the purposes of our analysis, but we will give the substance of them in this place.

He found that the changes, from a healthy condition of the patches to an alteration of structure, took place sometimes, in a gradual manner; but generally it was the reverse, and with all, or nearly all, the different degrees of the lesion were found in the same patient. In passing from the patches which were least altered to those which were most so, he found that they presented the following appearances: the first were very slightly elevated and pale, or of a faint rose colour; the orifices of the crypts were obliterated, and there was slight softening of the mucous membrane; next, came patches in which the thicken-

\* Flint's First Report, p. 53.

† Ibid. p. 83.



ing, softness, and redness were more marked. "The first of them had in some cases a surface which was granulated, upon which was seen a greater or smaller number of the open orifices of the crypts. In this state of alteration the most remarkable effects of the lesion was the development, and, if we may so express it, the *exaggeration of the natural structure of the parts*." The patches were raised, and also the mucous membrane which aided in its formation. The submucous cellular tissue was more or less affected, and of a pale rose colour.\* These conditions became more and more marked and exaggerated—that is, the patches became thicker, redder, and softer, till various stages of ulceration are detected; some superficial, and just commencing, with an imperfect destruction of the mucous membrane; others deeper, with its entire destruction. Sometimes they are distinct, at others they run into each other, so that the entire destruction of the mucous membrane over the whole extent of a patch is thus produced. The submucous and muscular coats also participated in these alterations, and the peritoneum became ruptured. Sometimes these alterations took place very rapidly, and perforation of the intestine would result at an early stage of the disease.

In many of the cases which died late in the disease, he found evidences of a reparative process having been set up in these ulcerated patches, and this was always more marked in that region of the intestine in which these ulcerations had begun, viz., the vicinity of the cœcum. In addition to the above, Louis also describes other changes that relate to the elliptical plates, which, he says, are peculiar to the submucous tissue. "Instead of being simply somewhat reddened and moist, without other change of structure—instead of partaking in some measure of the inflammation of the mucous membrane which covered it, as in the preceding variety, the cellular tissue was transformed, either through the whole extent, or nearly the whole extent of the patches, into a homogeneous substance, without apparent organization, of a pale rose or yellow colour. It was from two to three lines thick.

"It was easy to see that this substance was not secreted *from the surface* of the submucous tissue, *but into its substance*, on making an incision through it. These deposits were covered by mucous membrane, more or less reddened in proportion to its advance towards ulceration, which was the ultimate tendency of the parts in which they occurred." Louis says these deposits occurred in some-

\* Louis's Researches on Typhoid Fever, vol. i. p. 174.

what less than one-third of his cases. In relation to the character of the deposit, M. Vogel remarks: "This must in every case be deposited in a fluid state, and subsequently assume the solid form by coagulation; otherwise, it would not so completely fill up all the interstices between the tissues. Upon examination, however, it is always found coagulated; at least, I am unacquainted with an instance where it was observed still fluid." Again, he says: "The question of the origin and signification of this typhus matter can only be partially answered by pathological anatomy." It appears to be ascertained that this matter is secreted in a fluid state from the *capillary vessels*. Moreover, the cause of this separation is doubtless a local hyperæmia of the vessels; which, indeed, may be readily proved by direct observation. The secreted matter is therefore a part of the blood, which, shortly after its separation, coagulates. But we are acquainted with no principle of the human body which is capable of spontaneous coagulation, but fibrin. Of this, therefore, the typhous matter must principally consist—it is, as in similar cases, pervaded by the other elements of the blood.

"The question here suggests itself—Is this fibrin normal, or has it undergone a specific change? The possibility of such a change cannot be denied, since we know that fibrin is very transmutable; but the assumption of such a change, without a demonstration of its nature by organic chemistry, is of no advantage in a scientific point of view. By such a hypothetical transmutation of the fibrin, we may endeavour to explain—*Why the typhous deposit is not converted into normal pus, but breaks up without any distinct organization.*

"To this view may be opposed another, equally plausible. *It is very probable that, in typhus, the normal properties of the tissues are deprived of their ordinary energy, and that the formative power is impaired. In this diminished energy of the original tissues may likewise be sought the reason why the exudation does not become organized, but undergoes disintegration.* With this brief view of the subject, I wish to express myself as opposed to the opinion that there exists in the blood a specific typhous matter, with the deposition of which (in certain parts of the body) the disease localizes itself, and terminates."

From the above, it would be plainly inferred that the deposit depends upon a congestion or hyperæmia of the capillaries of the mucous and submucous tissues differing in character from inflammation—rather a condition of stasis similar to what has been observed



in the capillaries of the cutaneous surface in the typhus type of continued fever.

Another variety of disease in these follicles is mentioned by Forget under the name of *gangrenous*. The substance of the gland loses its vitality and becomes of a yellowish or greenish colour; its edges, growing ragged and shreddy, are detached, and finally the entire gland is thrown off. Dr. Jenner says that "when the whole of the deposit has sloughed out no fresh deposit is formed, and consequently, as the whole of that deposit is seated in the submucous tissue, destruction of the muscular fibres of the intestine must be the result of simple ulceration."

In addition to the above alterations in the small intestine, which refer exclusively to the glands of Peyer and Brunner, there are other conditions of this viscus which we consider no less important in an impartial analysis of the phenomena of typhoid fever. We refer to the congestions of the *general* mucous surface independent of the elliptical patches. It has been so uniformly the habit of pathologists since the time of Louis and Chomel, to regard every other abnormal appearance in the mucous surface of the small intestine as entirely of a secondary nature, that though we find, it is true, a sufficiently accurate description of these changes, yet certainly no stress is laid upon them, nor are they generally allowed to have any important significance in the pathological relations of the disease. It is not our object to give any very extended and minute description of them, but having formed views somewhat peculiar in regard to the ultimate pathology of this disease, and regarding this condition of the mucous surface as affording a corroboration of those views, nearly as strong as that afforded by the follicular changes themselves, we would, on no account, pass them over without decided reference. Thus, we find the mucous membrane, independent of the elliptical plates and isolated follicles, to be, in a majority of cases, preternaturally red. This redness is sometimes continuous, at other times it is in zones or patches. It sometimes extends over a large portion of its tract. In some cases, where there has been hemorrhage from the bowels, blood is found in the intestine, and in addition to this, the mucous membrane is the subject of *sanguineous infiltration*, and *this condition of the membrane is observed where there has been no hemorrhage*. It may exist to the extent only of a few inches, or of several feet. It is generally continuous, not in patches or zones. The colour of the membrane ranges from a rose to a very dark red, and it has a peculiarly brilliant and trembling or quivering

appearance, like jelly. Chomel found this lesion in seven out of forty-two cases. He is very confident that it is intimately connected with the hemorrhage from that portion of the membrane which it occupies.\*

The point in reference to this condition of the mucous membrane to which we would call attention, is this: that it indicates most positively an enfeebled condition of the bloodvessels, resulting in that complete stagnation of the blood which is denominated *stasis*, and the analogue of which we described somewhat at length, as occurring in the cutaneous congestions of the typhus type of continued fever. And not only do we claim this appearance after death as corroborative of this view, but in as strong a degree do we attribute the hemorrhages to the same condition of the vessels.

There is one more point in relation to the small intestine and we have done, and that is the almost entire exemption of the *duodenum* from ulcerations and the peculiar lesions of typhoid fever. Louis's reports show that this portion of the small intestine was healthy in nearly all his cases, with the exception of being somewhat reddened and sometimes softened, but rarely ulcerated.

THE LARGE INTESTINE was found the subject of pathological changes in a good number of cases. Besides the condition of meteorism, which was very common, its mucous surface was found reddened with more or less deep shades; also thickened and softened conditions were not uncommonly met with. Louis says: "The parietes of the large intestine became thicker than usual, sometimes resembling the condition in which we find the coats of the small intestine in *strangulation*. . . . Its mucous membrane was white in thirteen of his cases, and red, over a certain extent, in twenty, grayish in nine; it was of its usual consistence in one-fourth of the cases; it was softened, in various degrees, over a greater or less extent of surface, and was sometimes thickened in the others. Eight presented a certain number of lenticular crypts, few of which were ulcerated; four had hard, some rounded patches similar to those of the ileum; fourteen had ulcerations, which were generally few in number, superficial, and of small size."†

Dr. Bartlett speaks of the mucous membrane as presenting ulcerations in about one third of the cases, and that they were present in

\* Bartlett. Treatise on Fevers, p. 93.

† Researches on Typhoid Fever, vol. i. p. 376.



twenty-three of seventy-four examinations made by Louis and Barth. He says that they occupied most frequently the cœcum, though they were not confined to that portion of the intestine. In a small number of instances the submucous cellular substance of the isolated follicles were found to have undergone the same yellowish transformation that has already been spoken of as occurring in the elliptical plates of the small intestine.\*

Although the large intestine has been found less frequently the subject of disease than the small intestine, still its *post-mortem* phenomena are, in our opinion, of too frequent occurrence and of too decided a character, to be regarded as altogether secondary, and in our analysis it will be our object to show that these, like many other of the pathological conditions presented by the various organs, are not more of a secondary nature than are the changes of the elliptical plates of the ileum themselves, and, like these changes, are the direct result of causes common to both. Which causes, in our opinion, are identical with the ultimate pathological condition upon which all the phenomena, both symptomatic and anatomical, depend. To the investigation of their nature and influence we will presently turn our attention.

*The lymphatic ganglia* of the mesentery are very generally found in a diseased condition, and the amount of disease which they evince seems to correspond with the condition of the elliptical plates of the ileum, though this is not invariable, for those found between the two layers of the mesocolon are often found in the same diseased condition. The changes consist generally in enlargement, softening, and alteration of colour—red, bluish or gray—and in the deposition of purulent matter in their interior, marked by small yellow points.

In the course of the foregoing summary we have very constantly kept in view the differences between the two types of continued fever, although not with that order and regularity which would be necessary in a systematic treatise on the two diseases. It was only important to notice these differences, as they were suggested by the description of the symptoms of the typhoid type. Farther, it will have been observed that in our description of the symptoms occurring under the head of disturbances of the digestive organs, as well as in the account of their pathological lesions, we have instituted no comparison between the two types. The reason of this omission has been, that in the typhus type, none of the symptoms during life, or

\* Treatise on Fevers, p. 100.

the *post-mortem* appearances, pertaining to these organs, seemed to have any important connection with the characteristic phenomena of the disease, there being neither *diarrhœa* nor important intestinal lesion reported with any degree of uniformity in the typhus type;\* and, moreover, of late years the basis of distinction between the two types has been the existence or non-existence of disease in the intestinal canal; as will be observed in the admirable Treatise of Professor William Jenner, of London, on the Identity or Non-identity of Typhoid and Typhus Fevers.

The object of the present treatise being to arrive at what we consider the true, or, at least, the most rational theory of the typhoid affection, by an analysis of some of the most prominent phenomena in its natural history, an extended review of the many doctrines now in existence in relation to its pathology, would be inappropriate. Suggestions regarding the proximate cause of typhoid fever, will, we fear, meet no great degree of favour, for there is no disease in relation to which so many theories have been promulgated. The peculiar condition of the blood, the cerebro-spinal system, and the various abdominal viscera, have been each referred to as the pathological domain of this mysterious disease; yet neither, it appears to us, is alone adequate to the entire explanation of all its phenomena.

If we refer it to the state of the blood, and argue on the one hand that the continuously rapid and feeble pulse, the pale and softened condition of the heart's substance, the slight cutaneous eruption, the obstinate passive *diarrhœa*, the pain and tympanites, the congestion, stasis, and hemorrhages in the intestinal mucous membrane, as well as the changes and ulcerations in the elliptical plates, found in typhoid fever; and, on the other hand, that the still more rapid pulse, more softened condition of the heart's substance, together with the stasis and hemorrhagic spots (*petechiæ*), found on the cutaneous surface, are all the common result of these changes in the blood, and of these changes *alone*; and if we farther admit, with Andral and Gavarret, that these changes consist mainly in hypnosis, we must at the same time, admit that the theory is embarrassed by a great fallacy, viz. that the blood is often in the very opposite state, hyperinosis, for a considerable time during the course of the attack,

\* Spontaneous *diarrhœa* is as *rare* a symptom in typhus as it is a common one in *typhoid* fever.—Bartlett, p. 216. Amongst Dr. Gerhard's cases: "In the entire number of autopsies there was but a single case, and that of doubtful diagnosis, in which the slightest deviation existed from the natural appearance of the glands of Peyer."—*Ibid.* p. 233.



and yet no corresponding change in the symptoms is manifested. And farther, could we reconcile this, we would still find it difficult, without admitting the influence of other causes, to account for the production of such very dissimilar results in the two types; the principal manifestation of disease being in a *mucous* membrane in typhoid fever, and in the *skin* in typhus fever.

In relation to the cerebro-spinal system, for reasons sufficiently obvious, we would find it impossible to explain all the phenomena of the disease by here locating its proximate cause; for neither is the character of these phenomena taken as a whole, such as would be recognized as resulting from disease in the cerebro-spinal axis, nor is the correspondence between the severity of those symptoms which are plainly referable to this system, and the gravity of the more characteristic symptoms of the disease sufficiently close to authorize such a conclusion.

A very natural, and on a cursory view, almost inevitable theory, in regard to the pathology of typhoid fever, is that it must be either solely dependent upon, or very closely connected with, that invariable, and generally very serious amount of disease in the lower portion of the small intestine. This lesion, it cannot be denied, presents a greater amount of correspondence between its actual extent and the severity of the general essential symptoms of the disease, than any other set of phenomena connected with it. Louis, if he does not entertain this theory of the pathology of typhoid fever himself, has certainly, in his admirable statistical researches, afforded the strongest corroboration to others for their belief, and is often found expressing himself in a manner very favourable to this doctrine. "Notwithstanding," says he, "the small number of complications, and the comparative importance of each one of them, the symptoms were the same as in a great number of cases, in which the secondary lesions were much more grave; and this with other nearly similar facts, shows that almost all the symptoms observed in typhus fever, and *especially those which may be called characteristic, depend on the peculiar morbid changes in the ileum.*"\* And again: "We must conclude *that the time, at which the alteration of the elliptical patches of the ileum commenced, was the same as that of the disease;* and we must not consider this lesion as one of the effects of the fever, but that it forms the anatomical characteristic of it."†

\* Researches on Typhoid Fever, vol. i. p. 82.

† Ibid. vol. i. p. 92. It is with great reluctance that we attempt an interpretation of Louis's doctrine as favouring the opinion, that the above changes are the proxi-

From the above it would appear, at the very least, that Louis regarded this lesion as one of the greatest etiological importance. But when we give all the facts in connection with the abdominal lesions a more careful consideration, we must find that it is impossible to account for all the "characteristic symptoms" of the disease, by locating its ultimate pathology in this region, for although there is a more regular correspondence between the lesions and the symptoms, here than elsewhere, still, to attribute the symptoms *entirely* to this local lesion, appears unreasonable, when we reflect that in *typhus* fever, a disease at least *similar* and even by many considered *identical*, there is, as the rule, no trace of such a lesion, no trace of the diarrhœa, or of the pain and the meteorism resulting therefrom. Under this view, one of two positions must be assumed, either that those symptoms, which the two types possess in common, and which endow them with the typhoidal aspect, are due to conditions of the organism which have no analogy in the two diseases, and that typhoid and typhus fever are two distinct diseases. For if the characteristic symptoms arise solely from the intestinal alterations in typhoid fever, as these alterations do not exist in typhus, those symptoms must have their cause elsewhere. Now it would be very surprising if two sets of symptoms, so exactly simulating each other, that the most skilful and experienced have denied the least difference between them, should arise from entirely different causes, the one depending upon intestinal follicular disease, the other upon some as yet unknown cause. Certainly, such a conclusion would not be very philosophical. This theory, then, like the others, requires to be presented in no other light than the above, to show its inadequacy to the explanation of the phenomena of the typhoid form of fever.

It may be asked, what theory then can be advanced, to which so many rational objections will not be urged? We candidly answer *none*; but in our opinion, in the adoption of a theory of this disease, we should consider that most stable and philosophic, which, while it is as competent as any of the foregoing to the explanation of all the phenomena of the *typhoid* type of fever, yet, presents nothing which would exclude altogether from the same order of diseases, its

mate cause of typhoid fever; the more especially, as Dr. Bartlett, than whom no one in this country, in our opinion, is better qualified to do full justice to this great pathologist, has expressed his unbelief that such was his opinion. We may be mistaken in our interpretation of his expressions, and, therefore, have not charged the doctrine upon him, and have only remarked that he appears to have favoured it very decidedly in the above-named places.



unmistakable counterpart—its archetype, typhus fever. For, it is undeniable, that these two diseases are inseparably bound together, in ties of the strongest and most indissoluble, though mysterious, affinity, and the necessity which any theory may involve, of separating them, is enough, of itself, to declare its absurdity.

The view which we have taken in relation to the proximate cause of typhoid fever, is, we are fully aware, liable to many objections, but after a careful consideration of it, in all its bearings and dependencies, we can but regard it as perhaps less obnoxious to fallacy than most of its contemporaries. "Pathology," remark Todd and Bowman,\* "is the physiology of disease; and it is obvious that no pathological doctrines can command confidence, which are not founded upon accurate views of the natural functions," it is equally necessary, we would add, that these views be *comprehensive* as well as accurate, for without due importance being accorded to *relative* physiology, we mean that important bearing and relation which the functions of one portion of the organism has to those of another in health, and more especially in a state of disease, we are apt to lose sight of all just reasoning and legitimate induction, and to pursue but the waifs and shadows of a most uncertain and devious philosophy.

We have seen by only a cursory view, that neither the humoral or sanguineous theory, nor the intestinal, nor yet, again, the cerebro-spinal or nervous theory of typhoid fever, will account satisfactorily for all its phenomena; we must, therefore, look elsewhere for an explanation of them. After the most careful and laborious consideration of the phenomena, relationships, and events of this truly mysterious disease, keeping in view, at the same time, as well as we were able, the *entire* physiological dependencies of such an intricate question, we are induced to regard the typhoidal state, manifested both in typhoid and typhus fevers, as a morbid affection of the whole or portions of the ganglionic system of nerves, known also as the great sympathetic nerve, but of the exact nature of which, and how produced, we know not. In the succeeding analysis, it will be our object to show that the characteristic typhoid phenomena are found to occur in a more marked degree, in those portions of the organism which are admitted to be, and in most cases can be demonstrated as being under the control of the sympathetic ganglia and their various nerves, and that the occurrence of other phenomena is

\*Physiological Anatomy, p. 28, London edition. "It is also certain that improvements in pathology must follow in the wake of advancing physiology."—*Ibid.*

the result of relations, more or less direct, with this important system of nerves. In the course of our examination, we shall endeavour to show that both anatomy and the most approved physiological doctrine of the present day, are, in a great measure, confirmatory of our position, and farther that it will be corroborated by the recorded experiments of this and the past century.

We are aware that referring the pathology of disease to the sympathetic system of nerves, though not without precedents of the most respectable and even revered character,\* is still at the present day somewhat unusual, and while, in the confidence of an honest, and if not enlightened, we can at least say, a *studied*, conviction, we argue the justness of this pathology, we would ask in the first place, that indulgence which the defects of our performance must necessarily need, and in the second, a full acquittal from the arrogance which we are aware is more than apt to be imputed to him, who would deny established, and substitute new doctrines in pathology.

In view of the neglect, of which, at least in this country, the nervous system, and especially this portion of it, is the subject, we would be unwilling to enter into our analysis without referring briefly, by way of refreshing the memory, to some of the most important features in the anatomy and physiology of the ganglionic system of nerves. In so doing, we will not embarrass our description with a discussion of the many theories in regard to its functions, but will give that which we have adopted ourselves as most rational, and which, fortunately for us, we are able to say is that most universally admitted by the best physiologists of the present day, and which vivisection, that best of all tests, has most plainly, and, to our mind, incontestably demonstrated.

THE SYMPATHETIC NERVE. ITS ANATOMY.—In this description, we shall give the views of the various authors within our reach who coincide with us in relation to the function of this nerve, using very much the same order of description, and also, when its terseness and comprehensiveness will admit, their language.

Under the title of the sympathetic nerve, say Todd and Bowman,† is comprehended a great subdivision of the nervous system, which presents certain peculiarities of structure and of distribution, whereby it is strikingly contrasted with the strictly cerebro-spinal nerves.

\* Lobstein, Structure, Functions, and Diseases of the Human Sympathetic Nerve.

† Physiological Anatomy, Chap. xxi.



It consists of an uninterrupted chain of ganglia, extending on each side of the vertebral column from the first cervical vertebra down to the coccyx, and moreover extending upwards beside the cranial vertebræ, and occupying spaces between the bones of the cranium and those of the face. The continuity of this chain is preserved by cords of communication which pass from one ganglion to another; the chains of opposite sides communicate with each other, at various parts, in the plexuses of nerves which originate from them. The ganglia are sometimes divided for convenience of study into cranial, cervical, dorsal, lumbar, and sacral, each of these regions, containing a number generally corresponding to the number of the vertebræ in each. From each portion, certain sets of nerves may be traced; these are, omitting the cords of communication between the ganglia—1st. *Visceral* nerves, which generally accompany branches of neighbouring arteries to the viscera; 2d. *Arterial* nerves, apparently devoted to arteries in the vicinity of the ganglia; 3d. Nerves of communication with the cerebral or spinal nerves, which emerge from the cranium or spine, near the ganglia. The visceral and arterial branches have a remarkable tendency to form intricate plexuses, which entwine around the bloodvessels, and the visceral branches are conducted by these vessels into the tissue of the viscera. Of the branches of communication, it is sufficient to say, that they connect the ganglia with the cerebro-spinal system of nerves by means of two different sets of fibres, which are called its white and gray roots. The gray root appears to connect the ganglia of the sympathetic nerve to the ganglia on the posterior root of the spinal nerve, while the white root appears to be a branch coming from the spinal nerve, and to receive an equal amount of fibres from its anterior and posterior roots. These fibres may be seen in every instance spreading out upon the adjacent sympathetic ganglion, passing through the vesicular matter of which it is composed, and following the course of the trunk of the sympathetic for a longer or shorter way, and then proceeding from it in connection with the gelatinous fibres chiefly, to supply the viscera. These fibres are regarded as branches of the spinal nerve, which are distributed in connection with the gelatinous fibres, which are considered the true and proper sympathetic fibres, and are derived from the ganglia. Carpenter\* speaks of the cerebro-spinal fibres passing into the sympathetic, and the sympathetic fibres passing into the

\* Principles of Human Physiology, p. 558, ed. 1853.

cerebro-spinal nerves at their roots. From the above, it would appear then that the sympathetic system consists in its intimate structure of two distinct kinds of fibres, viz. those which come from the spinal system of nerves and also of the true sympathetic fibres, which are called gelatinous, and are peculiar to this system, and which originate from the vesicular matter of the ganglia.

Thus constituted, the sympathetic system is found located as above described, in the various parts of the organism. In the head, four or five ganglia which are connected together by filaments; these are the ophthalmic ganglion which is situated in the orbit on the outer side of the optic nerve; from this ganglion which is in close connection with the third or motor nerve of the eye and also with the nasal branch of the fifth nerve, a sensory nerve, proceed various branches of distribution to the eyeball, under the name of ciliary nerves. This ganglion has a third root by which it is brought into connection with the superior cervical ganglion.

The other ganglia are the sphenopalatine, situated in the pterygo-maxillary fossa; like the lenticular ganglion, and indeed like every other sympathetic ganglion wherever found, it is connected with a cerebro-spinal nerve, viz. the superior maxillary or second division of the fifth pair, a sensory nerve, by two small branches, which join it from above. This ganglion distributes branches in a great variety of directions, but those which we describe as most nearly connected with our subject, are the *three palatines*, anterior, middle, and posterior—to the *mucous* membrane of the *hard and soft palate*, uvula, and to the *nasal mucous membrane*; the *sphenopalatine*—to the mucous membrane of the spongy bones and that of the septum. Also the Vidian or pterygoid branch, one branch of which enters the cranium and connects itself with a swelling on the portio dura, and another becomes a part of a plexus which surrounds the carotid artery, and finally is connected with the superior cervical ganglion.

The *Otic* ganglion is situated on the inner border of the foramen ovale near the inferior maxillary nerve. It is very plainly a sympathetic ganglion as shown by its structure, for in this we find the vesicles as well as the tubular and gelatinous fibres very distinct; indeed, it is often selected as a specimen for the microscope on this account. This ganglion is connected with the third division of the fifth nerve, which nerve is both *sensory* and motor in its function. This ganglion gives off various branches, some of which supply the cavity of the tympanum. It has also another branch which connects



it with the glosso-pharyngeal, which is distributed to the glands, follicles, and mucous membrane of the tongue. The last one of the cranial ganglia which we will describe is the *submaxillary*, situated in the substance of the submaxillary gland; it is connected with the gustatory branch of the fifth nerve, a nerve of special sensation, and its branches are distributed to the submaxillary and sublingual glands and their ducts.

The *Cervical Ganglia* are three in number, called superior, middle, and inferior. The superior, situated at the upper part of the cervical portion of the column, is connected by large branches with the first, second, and third spinal nerves. It sends branches up into the carotid canal, which divide and subdivide in such a manner as to form a complete plexus around the artery, which is called the carotid or cavernous plexus. With this plexus, there are numerous communications; one which we particularly mention, which goes to assist in forming the *tympenic* plexus; so here again it will be perceived that the internal auditory apparatus receives a supply of sympathetic filaments. Branches also accompany the various ramifications of the internal carotid artery in its distribution within the cranium. Communications exist between the various parts of the eighth and ninth pairs and this ganglion, and also a large trunk connects it with the middle cervical ganglion. Its visceral and arterial branches are those which supply the *pharynx* by forming the *pharyngeal plexus* with the branches of the glosso-pharyngeal and vagus; also a few filaments to the larynx accompanying the laryngeal branch of the vagus. The most important branches from the second and third cervical ganglia are those large branches which, together with a smaller and more variable branch from the superior ganglion, serve to supply the *heart*, *principally*, with its innervation, under the name of superior, middle, and inferior cardiac nerves, which form plexuses under the name of cardiac, for the supply of this organ and of the *aorta*, some of them going to assist in forming the pulmonary plexus to supply the lungs.

The thoracic portion of the sympathetic system consists of a series of ganglia corresponding very nearly with the number of the vertebræ; these communicate freely with each other and also *with the roots of the spinal nerves*. They send branches to supply the *aorta*, which form the aortic plexus, and serve to constitute several large branches called the greater and lesser splanchnic nerves; they pierce the diaphragm, the former joining the great semilunar ganglion, and the latter the renal and aortic plexuses. The *lumbar and sacral*

*portions* of the sympathetic are connected with the dorsal or thoracic portion, sometimes by a small intercommunicating cord between the last dorsal and first lumbar ganglion and sometimes by the lesser splanchnic nerve. They, like the above, have numerous and very distinct communications with spinal nerves, and form plexuses for the supply of some of the abdominal and of the pelvic viscera, together with the lower portion of the aorta under the name of inferior aortic plexus.

In addition to the above ganglia, which are usually denominated, from their location and close connection with the general nervous system, the spinal or vertebral sympathetic ganglia, there are others of not less, and by some authors considered of infinitely more importance; we refer to the *isolated* ganglia, situated within the thoracic and abdominal cavities, and which appear to have comparatively but little direct and intimate connection with the cerebro-spinal system or with the external parts of the organism, and to be devoted to the viscera entirely, and therefore are with their branches pre-eminently entitled to the denomination of *visceral ganglia* and *nerves*. These are found in various situations, several of them in connection with the various cardiac plexuses,\* but the most important are found in the abdominal cavity forming the centres of the solar plexus, under the names of greater and lesser semilunar ganglia; from these pass off plexuses accompanying and corresponding in name with the various branches and sub-branches of the cœliac axis, and conducted by them into the organs, for which they are manifestly intended. Todd and Bowman thus describe these plexuses: "The nervous plexuses of the abdomen are extremely complicated and numerous. They are principally derived from two great ganglia, situated, one on either side of the cœliac axis, in front of the aorta. These ganglia are semilunar in shape, convex downwards and outwards; they unite below the cœliac axis; and chiefly from the convex border, a vast radiation of plexiform nerves takes place, which follow the course of and entwine around the branches of the cœliac axis, and other branches of the aorta. To this great radiator, anatomists have given the name of *solar plexus*, and the conjoined semilunar ganglia must be looked upon as the great centre—the *sun* of the abdominal sympathetic system."

\* Several ganglia are found in connection with the nerves of the heart. Wrisberg describes one near the arch of the aorta, and Remak describes and figures several among the anterior and posterior cardiac plexuses, and in the substance of the heart.—*Todd and Bowman*, p. 505.



From this solar plexus proceed subdivisions or smaller plexuses, corresponding with the arterial trunks in this region, as the diaphragmatic plexus, a small network accompanying the phrenic arteries, and the supra-renal arteries. 2d. The coronary or gastric plexus, which assist with the pneumogastric nerve in the supply of the stomach. "Of these filaments," says Cruveilhier, "some ramify upon the *cardia*, while the remainder follow the coronary artery along the lesser curvature of the stomach. *It follows, therefore, that the stomach is principally supplied by the pneumogastric nerve. The cardia and the lesser curvature of the stomach are the parts which are the most abundantly supplied with nerves.* The pylorus, to which we attribute such great sensibility, has incomparably fewer nerves."\* To the liver there are sent, in great profusion, branches, from this great plexus, which constitute the *hepatic plexus*, the branches following the course of the arteries, and being conducted by them into every portion of the intimate tissue of the organ. For the spleen there is the splenic plexus, and so likewise the renal plexus for the kidneys; though this last, together with the inferior mesenteric and spermatic plexuses, are not so directly offsets from the solar plexus, being more distinct from it than those above described.

Lastly, as most intimately connected with our subject, we describe more fully the *superior mesenteric plexus*, which supplies the greater portion of the intestinal canal, accompanying the ramifications of the superior mesenteric artery to wherever these are distributed. Finding the most concise, and, at the same time, most pertinent description of this plexus in Cruveilhier's Anatomy, we prefer to use his words: "The superior mesenteric plexus, which may be regarded as the lower division of the bifurcation of the epigastric plexus, is the largest of all the abdominal plexuses; it surrounds the superior mesenteric artery, forming an extremely thick plexiform sheath for it; it passes below the pancreas, enters the substance of the mesentery with the artery, and divides, like that vessel, into a great number of secondary plexuses, which are distributed to all parts supplied by the artery, namely, the *whole* of the *small* intestines, *excepting the duodenum*,† and right portion of the great intestine.

One more point in relation to the anatomy of the nervous system in reference to this subject, and we have done; we refer to the very

\* Treatise on Human Anatomy, p. 867, and marginal note.

† Dr. Todd, in the Cyclopædia of Anatomy and Physiology, says that the duodenum is supplied by the cerebro-spinal system of nerves.

close connection that exists between the ganglionic system, and the pneumogastric or par vagum nerve; both in the substance of the lungs and in the superior cervical ganglion,\* as well as in its relations to the semilunar ganglion, so close is this latter connection, that some authors have even regarded the whole nerve as originating from this ganglion,† a surmise which, we must admit, is altogether unfounded; but still, it serves to show the character of this connection, as well as in some measure the character of function attributed to this nerve.‡ Dr. John Bird, in his experiments on the nerve, found that its section produced, besides other symptoms, a peculiar congestion of the lungs, *resembling* pneumonia, which congestion was, no doubt, attributable to the cutting off from the lungs the supply from the sympathetic system. This, then, brings us to a consideration of the *functions of the sympathetic system*.

In the physiology of the nervous system, if there is one fact better established than another, it is, that the ganglionic system, whatever else may be its functions, presides over and controls the important act of circulation, secretion, and nutrition; or, at least, forms a necessary element in these functions. Anatomy, both special and transcendental, as well as vivisections and physiological experiments, all serve plainly and incontestably to demonstrate this fact in relation to its office. "Clinging to the coats of the arteries, it follows them, for the most part, in their ramifications, and attaches itself to them, as the ivy does to a tree." It seems to be nerve of the bloodvessels, and as, remark Todd and Bowman, "secretion is mainly dependent on the normal nutrition of glands, it is reasonable to suppose that that function would be, to a certain extent, controlled by these nerves." Dr. T. B. Proctor, in a very sensible treatise on the sympathetic nerve, says: "It is quite clear, from the important and interesting experiments made by Wilson Philip, Legallois, and Fleurens,

\* Todd & Bowman, pp. 488 and 502, Physiological Anatomy, American edition.

† "I am perfectly aware," says Dr. James George Davey, of London, "that Dr. Stevens maintains both the vagus and spinal accessory nerves derive their origins not from the medullæ oblongata, but from the upper part of the semilunar ganglion. But I cannot think so."—*Vide* Ganglionic System, *London Lancet*, vol. for 1851.

‡ This nerve, from the resemblance in its functions to the sympathetic, has been called the lesser sympathetic nerve, and it is remarkable that, in that class of animals in which the sympathetic is said to be deficient, or nearly so, its place is supplied by the pneumogastric.

"In the cyclostomes among fishes," says Wagner, "the sympathetic is either wholly or in major part, replaced by the par vagum; the same thing occurs among serpents."—*Elements of Special Physiology*, p. 514.



that neither the brain nor nerves of the spine have anything to do with the circulation of the blood; as it could be seen that animals lived for some time, and the circulation went on with vigor, after the brain and spine had been removed, separately, and also conjointly. It is self-evident, then, that it is *to the sympathetic (and to that alone) that we must look as the regulator of the arterial system.* And it will be observed that, in all parts of the animal body where large and sudden supplies of blood are required, such as the heart, stomach, bowels, and organs of generation, we have the sympathetic or ganglionic system very fully developed, and as far as I can judge, in ratio to the amount of blood supplied to these several organs. On the contrary, in some parts of the body, and in the extremities, where the flow of blood is more regular, and not subjected to those sudden calls for large supplies of blood at irregular periods, we find this nerve manifestly decreasing in size; and, indeed, as far as we can judge with the naked eye, ceasing altogether in some parts. Still, I perfectly agree with Sir Charles Bell, *that it is distributed all over the body*; but whether its influence is confined to regulating the small vessels which supply the coats of the arteries, or whether the same influence is continued by it over the whole circulating medium of the extremities and other parts that it manifestly exerts over the abdominal viscera, must, I fear, be left to a more enlarged inquiry.”\* Dr. Carpenter, who believes somewhat differently from the above, and, with most physiologists of the present day, namely; that the sympathetic nerve derives whatever of sensory and motor power it possesses from the anterior and posterior column of the spinal cord, expresses himself in the following apposite manner in regard to the functions of the sympathetic as a whole. “It seems fair to conclude that the motor power of the sympathetic system—which is chiefly exercised on the *muscular substance of the heart and walls* of the bloodvessels, on the *muscular coats of the alimentary canal*, and of the large gland-ducts which open into it, and on the muscular walls of the genito-urinary organs—is entirely derived from the cerebro-spinal system. In no instance, however, can the will† exert any in-

\* Medico-Chirurgical Review, Jan. 1845, also Treatise, separate, p. 21.

† We do not wish to deny this assertion; but there is on record one familiar case, which would appear at first sight strongly contradictory of this statement, that of Col. Townsend, who is said to have had such entire control over the action of his heart that he could make it cease to beat at any time, and virtually die, and live again, so far as the circulation was concerned, at will; but, on one occasion, having

fluence over the movements of these parts; they are strongly affected by emotional states of the mind, and they frequently seem to respond to impressions made on remote organs. If, then, the sensori-motor endowments of the sympathetic trunks be restricted to those fibres which are really cerebro-spinal in their origin or termination, it remains to inquire what are the functions of the *true* sympathetic fibres, whose vesicular centres lie in the ganglia of the sympathetic system. Upon this point, we can only surmise; but there appears strong grounds for the conclusion, *that the office of these fibres is to produce a direct influence upon the chemico-vital processes concerned in the organic functions of nutrition, secretion, &c.; an influence which, although not essential to the performance of each separate act, may yet be required to harmonize them all together, and to bring them into connection with mental states.*"\*

Sir Charles Bell's† opinion is somewhat similar. "We are left to the conjecture that the sympathetic or ganglionic system of nerves, according to Bichat, are for those thousand secret operations of a living body, which may be called constitutional: *circulation, secretion, and absorption*, are operations which simultaneously affect the entire frame."

From the above, then, it appears that the sympathetic system, as a whole, being composed of intrinsic gelatinous fibres and cerebro-spinal or tubular fibres, has two distinct and separate offices to perform in the animal economy, viz. 1st, by virtue of its cerebro-spinal or tubular fibres, to preside over the movements and sensations (what little they possess) of the *heart* and other involuntary muscles, as the muscular coats of the *intestines, bladder, and the coats of the various excretory ducts*; and that it is the source of *intrinsic motory power to the bloodvessels, these depending upon this system for their innervation*; and, secondly, that by its vesicular and gelatinous portions, it presides over the chemico-vital operations of the animal organism,

willed himself to death for the amusement of some friend, he carried the experiment too far, and life became extinct.

This peculiarity was probably due to an unusually large supply of filaments from the pneumogastric and spinal nerves, as is very frequently observed in dissections, or as we would now suggest, it was attributable to disease of those fibres of the sympathetic which belong essentially to it, and of the ganglia, by which disease those parts had lost their *isolating power*, so that the cerebro-spinal influence, over which the *will* presides, was transmitted unembarrassed to the heart. This case certainly should not detract from the force of Dr. Carpenter's remarks.

\* Principles of Human Physiology, 1853, p. 830, *et seq.*

† On the Nerves, p. 11.



concerned in *digestion, secretion, absorption, &c. &c.* In a few words, then, it presides over the functions of all the involuntary muscles, and controls circulation and secretion.

### PATHOLOGICAL DEDUCTIONS.

Having thus carefully recounted the more important features in the anatomy and physiology of the sympathetic system, it remains but to consider them in connection with the phenomena of typhoidal fevers. Such a review will be attended with the following results. In the first place, the essential symptoms of typhoid fever are located in organs deriving their innervation principally, and in many instances, entirely from the ganglionic system: In the organic or involuntary muscles—as for instance the *heart's*—of which, during life, we find the frequency increased, the force diminished, and the regularity impaired—all of which effects must be plainly attributable to the *altered innervation* of the organ. After death, we have seen it the subject of very material alteration; its substance is flabby, pale, and much softened, so that it breaks readily under the fingers. Instance again, the *muscular coat* of the intestine; we have *meteorism*—an almost invariable symptom in typhoid fever—and which we may legitimately refer to the loss of *tonicity* in the muscular coat of the intestinal canal, from impaired innervation of that coat, by which condition, together with the altered state of the secretory surfaces, the passive accumulation of gas in the intestines is allowed, and hence the tympanites.

That this altered condition in the innervation of the organic muscular fibre does exist, is shown most remarkably in the mode of dying in some cases, viz., that mode termed *asthenia*, “occasioned by causes acting directly on the circulatory forces, affecting the *vis nervosa*, upon which the contractile property of the heart depends,”\* and farther, that this depression in the involuntary muscles has no invariable correspondence in the state of the voluntary muscular system; as we shall find remarkably illustrated in the observations of Dr. Flint.† “In some of the cases attended with most danger, and some of them ending fatally, the *muscular strength was retained in a surprising degree*. In two fatal cases of the typhoid type, characterized by active persistent delirium, the muscular efforts were almost constant and quite strong up to a few hours before death. One of these cases

\* Flint, p. 125.

† Reports on Continued Fever, p. 59.

terminated on the ninth day, and the other on the third day after coming under observation. The mode of dying in each was by *asthenia*, or, perhaps, more properly, *necræmia*; *the system of involuntary muscles exhibiting reduction of force to a degree incompatible with life—the voluntary muscles remaining active*. This is a curious fact."

This relative condition of the voluntary and organic muscular systems, appears to impress even the observing and philosophic mind of Dr. Flint as almost inexplicable; and it is not surprising that it should, when we consider that his views of the pathology of typhoid fever have no fixed or definite reference to the organic system of nerves; but, on the admission of the ganglionic pathology of the disease, the full interpretation of these phenomena, besides many other similar facts (meteorism) before inexplicable, become easy and natural.

II. Besides the organic muscular system, which we have just shown to be under the influence of ganglionic nervous aberration, we find that the other characteristic phenomena of typhoid fever refer to the functions of nutrition and secretion, both of which important processes depend upon the vascular system, which, especially in the viscera, are admitted to be under the sole dominion of the sympathetic nerve. And, what is more remarkably illustrative of this fact, is, that there appears to be a very close relation between the amount of disease observed in any particular portion of the organism—the alimentary canal for instance—and the degree to which it is indebted to the ganglionic system for its innervation; thus we find but a small amount of disease, congestion, seldom any ulceration, in the *larynx*; ulceration is somewhat more common in the pharynx, œsophagus, and stomach, though still not abundant. It disappears in the *duodenum*, which receives but few sympathetic filaments, and again appears in the upper portion of the *ileum*, increasing, as we descend, *in direct proportion* to the amount of ganglionic fibres the part receives, till it reaches its maximum in the lower portion, where the nervous supply is very abundant; after which, we find ulceration *occasionally* in the cœcum, still less frequent in the colon, till in the *rectum*, whose innervation is principally from the cerebro-spinal system, it is never observed. So, likewise, with regard to the other organs; we find the *liver*, *lungs*, and *spleen* are all subject to congestions, which can be referred to the same abnormal innervation of these viscera.

From the relative unfrequency of disease in certain portions of



the abdominal viscera, and elsewhere, Louis, as we have seen, though admitting their diagnostic importance, is disposed to view them as results, secondary to the lesion in the ileum; we cannot, however, agree with him, but are compelled to regard them as the *common primary results* of a *common cause* which exists in the ganglionic system, and that the frequency or the gravity of disease in any one of these organs is determined alone by the amount to which the *ganglionic ingredient* mixes with, or enters into its innervation, and that disease in these localities has no etiological reference whatever to that in the ileum; but, when it exists, is as significant of the true pathology as is the ileitis—for it invariably indicates, both by its location and character, that its origin is *abnormal innervation*.

So far then as regards the *localities* in which the manifestations of typhoid fever occur, we have found an exact correspondence with the distribution of the sympathetic nerve, as likewise between the *amount* of disease and the proportion of this kind of innervation in any given parts. Now it will be our object to examine carefully, in order to ascertain if there is any analogy between the *character* of these typhoidal phenomena, and of those results which have been obtained by experiment upon this system of nerves. In this interesting department of physiological inquiry, there have been many engaged, but a few will answer very well the purposes of our comparison. As early as the year 1732, Pomfour du Petit found that the *division* of the trunk of the sympathetic, opposite the fourth or fifth cervical vertebra in dogs, was very rapidly followed by great disturbance in the circulation of the eyeball, producing inflammation, flattening of the cornea, retraction of the eyeball, with protrusion of a fold of the conjunctiva and a *flow of tears*, and ultimately ulceration and destruction of the organ. The experiments of Dupuy upon horses, wherein he *extirpated* the superior cervical ganglion, were followed by the same results with regard to the local effect in the eye, but also, with the more opposite and corroborative consequences, that there was *an eruption over the whole cutaneous surface*, with emaciation and an oedematous state of the limbs. Dr. John Reid, has also experimented on the sympathetic nerve in the neck, and found the eye similarly affected with the above, the *conjunctiva becoming red and congested* in a few minutes, while in other experiments\* the eye presented an *ecchymosed or bloodshot appearance*. Each one of these conditions of the eye must be borne in mind, in

\* Arneman's Experiments on Nerves. Gottingen, 1787.

order to appreciate the comparison; inasmuch as, on account of the great difficulty of making such experiments on other portions of the sympathetic system, we can find none on record which will serve as reference; for it will readily appear that, from the remote position of these nerves, it is impossible to make their section without so materially deranging other important parts of the organism as to render the results valueless in deduction.

Now, a reference to some of the pathological phenomena of typhoid fever, will discover a close analogy, if not identity to the above results; in the first place, the conjunctival congestion; its character, the attendant suffusion, together with the entire freedom from pain, even on exposure to the strongest light; while, at the same time none of the symptoms of true inflammation are present; all indicate the seat of the nervous derangement upon which it depends to be the ganglionic system\* and not the cerebro-spinal, the analogous derangements of which are invariably of a sthenic character, and attended with acute pain in the region in which they occur. Again, an attentive consideration of the character of these congestions will show that it does not vary in any respect, except in degree, whether occurring in the mucous membrane of the eye, that of the stomach, pharynx, small intestine, large intestine, or bladder, in the typhoid type, or on the cutaneous surface in the typhus. In all the above localities, and under all circumstances, we find the capillary congestions wearing the same aspect, assuming invariably a *passive* character, often approaching the condition of true stasis, but never attended with the florid redness, the pain or the swelling of active inflammation. Lastly, in the cutaneous petechial eruptions or maculæ of the typhous type of continued fever, we can also detect the same character of *passive congestion* from deficiency of nervous energy carried to a still greater degree; in this type, the nervous power of the cutaneous capillaries is so far diminished, that it amounts to a state of actual paralysis, allowing such distension of the capillaries that their rupture and a subcutaneous effusion is the result.

We have thus far endeavoured to show that typhoidal fevers result from alterations in the condition of the ganglionic nervous system; first, by comparing the typhoid phenomena with the normal action

\* Dr. A. Billing remarks, in relation to this subject: "Without, therefore, at present seeking for farther proofs, I deduce from blushing, and from the effects of electricity, fire, and cantharides, that the capillaries are dependent upon the nervous system for that tone or energy which preserves them from over-distension."—*The First Principles of Medicine*, p. 44.



of the sympathetic system, and we have found that the analogy is complete, and that typhoid phenomena are but the result of aberrations in the normal action of these nerves. Their action may be either exaggerated or diminished; for instance, a portion of this system controls the action of the heart, and in health endows this organ with a frequency of action amounting to 60 beats per minute in the adult; and without disturbing causes, this number will continue unvaryingly in its regularity till the close of life. But we know that this regularity is liable to many interruptions and disturbances; some of them but momentary, as from the emotions; others disturb it for many hours by increasing its frequency, as in paroxysmal fever; and lastly, in typhoid fever, we find this increase of frequency kept up for many weeks, but still retaining the remarkable feature of continuousness, which distinguishes the normal action of the sympathetic system from that of the cerebro-spinal system, which is intermittent in all its phenomena, whether normal or abnormal. Were we now requested to explain the difference which marks the increased frequency of pulse in these three instances; to answer why is it evanescent in one case; of but a few hours' duration in the second; and yet continue many weeks in the case of typhoid fever?—we think, we should do it thus: The heart, being under the dominion of the ganglionic system, performs its normal action through its influence; but from the intimate connection between the sympathetic and cerebro-spinal systems, especially in this organ, it is very liable to be affected by emotional causes acting in the brain; these, of course, will be evanescent; or it may be affected by causes acting in the spinal marrow, which may be more durable, as would be the case in a paroxysm of intermittent fever;\* but it will be observed that, in these cases, the organic system is only secondarily implicated, and so soon as the mental emotion subsides, or the spinal irritation is removed or has exhausted itself in a paroxysm, the excitor being withdrawn, the sympathetic becomes again normal, and the action of the heart consequently natural. But in continued fever, the case is quite different; the irritation is now located in the ganglionic centre itself, which supplies the heart, and consequently the increased frequency

\* We have adopted the pathology of intermittent fever advocated by Maillot, viz. that it consists in cerebro-spinal intermittent irritations. Prof. J. F. Lobstein remarks: "The paroxysms of intermittent fever are tied down to a regular rhythmus, in consequence of being radicated in the nervous system, upon which nature has impressed a law according to which they must perform their functions periodically.—*Sympathetic Nerve*, p. 121.

continues as long as this irritation remains, which is coeval with the duration of the disease. There is one feature of continued fever, to which, heretofore, we have seen no satisfactory explanation that we think can be accounted for rationally according to the pathology here suggested; we refer to the paroxysms and exacerbations which frequently complicate the course of continued fever. We would attribute these paroxysms to the extension of the irritation from the ganglionic to the cerebro-spinal centres, and we conceive that it is only under such circumstances that we find these intercurrent paroxysms masking the course of the typhoid affection. By this means there is effected a true *blending of types* from a blending of proximate causes, and the two sets of phenomena exist in combination; a continued fever characterized by paroxysms of exacerbation. In the same manner, on the other hand, can we conceive of paroxysmal fever becoming continued under favourable circumstances, by the transmission of irritation from the cerebro-spinal to the ganglionic system.

As the abnormal innervation in the sympathetic system can produce a continued accelerated action in the heart, in typhus and typhoid fever, so, likewise, can the diarrhoea of the typhoid type be shown to be a result probably of a similar condition. The normal action of the ganglionic system endows the intestinal canal and other viscera with the function of healthy secretion; but during the existence of the typhoid state this proper action is destroyed; in place of the organs being the seat of a normal and proper circulation, which is necessary for the due exercise of their function—secretion, the vessels become the seat of obstructions and congestions, the secretions become more abundant, but abnormal and vitiated; we have then *diarrhoea*. As these congestions become more marked, we find the paralyzed and over-distended vessels giving way, allowing submembranous effusions of blood, and occasionally considerable hemorrhages—all being the result of the altered condition of the innervation of these organs. Thus, what in its beginning was a purely dynamical affection, soon becomes organic; for without the proper supply of ganglionic nervous influence, we have seen, from the above-mentioned experiments, that the circulation ceases, the capillaries become turgid, especially in highly vascular secretory organs (as the mucous surfaces, or the glandular plates of Peyer, for instance), effusion of lymph takes place, and, as above stated, finally, the capillaries are ruptured, and the tissues in certain places rapidly disintegrate by the process of ulceration—which is the actual condition of things in the intestinal disease of typhoid fever.



From what has already been said in relation to the distinctive features of the two types of continued fever—typhoid and typhus, their interpretation, according to the pathology herein argued, will have been, doubtless ere this, naturally suggested. We have seen that *typhoid* fever is marked by an accelerated pulse, more or less nervous derangement, an altered condition of the blood, frequently a *mild* cutaneous eruption, diarrhœa, and meteorism. On *post-mortem* examination, we find lesions; viz. congestions and ulcerations of a peculiar character, that is, simulating those produced by experimental sections of the nerves in all those parts supplied by the *visceral* portions of the ganglionic system of nerves. On the other hand, we have seen that *typhus* fever is characterized by a somewhat more accelerated pulse, much more marked nervous derangement, the same altered condition of the blood, well-marked and *always serious* alterations in the capillary circulation of the *skin*, amounting often to actual ecchymosis, while the *post-mortem* examination shows almost entire *exemption* from lesion in the abdominal viscera. Thus, we find that while both diseases have all their general symptoms so exactly similar that we are forced to acknowledge their identity, and see in them what is essentially but one disease, yet typhoid fever has its principal and most prominent manifestations in the abdominal viscera—internally; and typhus fever manifests itself in aberrations of the circulation, very analogous to those of typhoid, but occurring in the capillaries of the *cutaneous* surface.

Now the ganglionic pathology is the only theory by which such marked incongruities in the two forms of what, to the observation and scrutiny of every one, must ever appear as one disease, can be perfectly and satisfactorily reconciled. We cannot deny that the two are but types of the same disease; yet how incongruous and strange it is that, in certain cases (*typhoid*), diarrhœa and intestinal lesion should appear the main—the most important features; while in the other cases (*typhus*), undeniably of the *same disease*, even more grave and threatening, there should be not a trace of diarrhœa, and on *post-mortem* examination no intestinal lesion whatever, but, instead, serious disease and congestion of the *skin*, with subcutaneous sanguineous effusions, similar to the submembranous sanguineous effusions of the typhoid type. Indeed, from the very smallest degree of attention must result the conclusion that, in the two cases, *the disease is one and the same*, but seated in different portions of the organism; and this conclusion will accord exactly with what we have considered the distinctive pathology of the two forms, viz.

that in each type the disease is located in a different portion of the ganglionic system. There are certain parts of the system which are affected in both forms of the disease—as the ganglia supplying the heart; but after this, the two types have entirely distinct and separate sets of ganglia, the morbid action in which gives rise to their respective manifestations. In *typhoid fever*, the *internal* or *visceral* isolated ganglia, such as the semilunar, &c., are the seat of the morbid action; and these supplying mainly, we may say entirely, the abdominal viscera, and having but little connection with the other or external portions of the organism, these viscera become the seat of nearly all the morbid phenomena; while that little implication of the cutaneous surface and general nervous system, which we often observe, is entirely due to the remote and very obscure connection which their isolated ganglia may have with the nerves supplying these parts.

Now, in the *typhus* type, the same disease, or morbid agent (its exact nature we do not pretend to define), affects an entirely different set of nervous centres—a set of ganglia which, by their anatomical position, their internal and universal relations with the anterior and posterior roots of the spinal nerves, are plainly destined to preside over the capillary circulation of parts more superficial—the cutaneous surface. We have reference to the *vertebral* sympathetic ganglia; and, in attributing the location of *typhus* fever to these ganglia, we have a ready and satisfactory interpretation of all its distinctive characteristics. The skin becomes congested and ecchymosed (petechial), because its circulation is dependent upon and controlled by innervation derived from these vertebral ganglia; which ganglia being the seat of abnormal action (perhaps paralysis), innervation is deficient, the cutaneous circulation is retarded; in certain places there is obstruction, with actual rupture and effusion, giving rise to petechiæ. The general (cerebro-spinal) system is more seriously involved in typhus than in typhoid fever, because the connection is more direct between the vertebral ganglia—which are the seat of typhus—and the cerebro-spinal system. In a word, then, we would locate *typhoid fever* in the *visceral* portion of the ganglionic system, and *typhus* in the *vertebral* portion.

We are fully aware that our views of the pathology of typhoid fevers would be greatly corroborated, could there be discovered any appreciable *lesion* in the ganglionic nervous centres, in subjects who have died during their progress; but, like the pathological anatomy of all the nervous system, this would be an investigation attended with



many difficulties; for histological changes in the nervous centres are of such a character that though they may be competent to subvert the intellect, entirely paralyze or destroy the functions of a large portion of the organism, and ultimately, upon the most positive rational evidence, *seem* to be the cause of death, yet on examination the alterations observable in those centres are of the most insignificant and irrelevant character, pertaining only to the involucre, while the centres themselves, which, from the previous symptoms, had been plainly the true seat of the disease, have been found apparently normal and intact. These changes, then, are probably molecular and inappreciable with our present means of investigation, and will require years, and far more perfect appliances, to incorporate them among the positive and demonstrable things of our science. Still, there are occasionally isolated facts, even in the *pathology* of the ganglionic nervous centres, which we may refer to in corroboration of our opinion that these centres are affected in typhoidal fevers, and that such affection gives rise to its characteristic symptoms, or to phenomena quite analogous in their nature. The case reported by Professor Lobstein is of this nature. It was that of a young girl who had suffered from paralysis of the lower extremities for some time, but for three months previous to her death laboured under the most incurable *diarrhœa* with tormina, &c. On making a *post-mortem* examination, there was found a large abscess on the left side, extending from the sixth to the tenth dorsal vertebra. On opening this abscess, it was found that the *trunk* of the left *sympathetic nerve* was entirely *destroyed* from the sixth to the twelfth vertebra, and in the *lumbar* portion the *same nerve* was in a state of inflammation.\*

There are also two cases reported as occurring in the practice of Dr. Aronsschön, of the Strasburg Hospital: The first, that of a man forty-seven years old, affected with *diarrhœa*. He died of a tumour in the abdomen, and it was found that "the *semilunar ganglia* were affected with *distinct inflammation*." The second case was a woman aged about thirty years, who, in her second pregnancy, was subjected to vomiting throughout the whole of her gestation. She was also affected with a *furfuraceous eruption* upon the breast and arms, with *swelling* of the *limbs*, and with *diarrhœa*. On a *post-mortem* examination, the villous coat of the stomach was found inflamed and thicker than usual, especially towards the pylorus, "and the *semilunar ganglia* were found in a state of *genuine inflammation*."

\* Structure, Functions, and Diseases of the Sympathetic Nerve, p. 147.

“In the body of a boy ten years of age,” says Lobstein, “who had died from the retrocession of a *miliary eruption*, attended with symptoms of great anxiety, oppression of the chest, and distension of the epigastrium, I found a place in the left trunk of the *intercostal* (which is the old name for the sympathetic) *nerve*, *highly inflamed* between the eighth and tenth ribs, *with a phlogosis of the ninth and tenth thoracic ganglia*, and their two anastomotic branches with the costal nerves.”

The following observations are quite pertinent to the state of congestion in which the lungs are almost invariably found, to a more or less degree, in typhoid and typhus fever. “On examining into the condition of the nerves in diseases of the lungs, I discovered another alteration which is peculiar to these organs; to wit, in that species of *peripneumony*, in which the lungs became red and *slightly indurated*,\* and which, I think, should be called spleenification; the *nervous filaments* attending the ramifications of the bronchia *were* found equally *red*, a little more tumid, but much more tender than usual; so as to be *broken by the slightest degree of force*.”† And, lastly, the same author‡ quotes a case still more in point, from the writings of Professor Autenrieth, of Tübingen, wherein it is asserted, though he does not appear to connect the circumstance with the pathology of the disease at all, that he has *seen the abdominal nerves of the ganglionic system somewhat changed in subjects who have died of typhoid fever*.

The above cases, though not conclusive, are at least strongly corroborative of our view of the pathology of typhoid fever; for while we must admit that the diarrhœa, the eruption, the pulmonary congestion, œdema, &c., might have been produced by other causes than disease of the ganglia found inflamed or divided, still, when these coincidental circumstances are viewed in connection with the known result of artificial section of accessible portions of the sympathetic nerve, as those about the neck and eye,§ and also in view of the entire dearth of experiments and facts bearing upon this portion of the ganglionic system, we must regard them as significant and valuable, even though they afford what we may term only a legitimate suspicion of the correctness of our pathological views.

\* Exactly what is described by Dr. Flint as the pseudo-pneumotis of continued fever.

† Lobstein, p. 139.

‡ *Op. cit.* p. 137.

§ See experiments of Panfour du Petit, Dupuy, John Reid, and others, already referred to.



We have now completed our investigations in relation to this intricate, but, at the same time, most interesting topic of pathological inquiry; we have reviewed its history, and collected from every source within our reach as complete a delineation of its prominent and characteristic phenomena as has been necessary for their full development. In so doing, we have been struck with the vast number of reliable and significant facts our science is in possession of, in regard to this disease. No disease in the catalogue is more invariable in its characteristic manifestations; no disease has been more diligently studied, or has enlisted in its investigation such faithful observers. Our knowledge in regard to its observed *phenomena* and *facts* is clear, well defined, almost certain; to complete the science in regard to it, it has but remained that these cognate, well-ascertained facts and phenomena be rationally and correctly *interpreted*, that its true pathology might be *deduced*. To this arduous, though not unpleasing task, not without many misgivings, we have earnestly and diligently devoted ourselves, more with the hope that our labours would prove suggestive to others of the true mode of arriving at the real pathology, than that we should be able to supply the want or remedy the deficiency.

Starting with what we considered the rational assumption that the pathology of typhoidal fevers is in the ganglionic system of nerves, we have compared their characteristic traits and phenomena with, first, the *normal* action of this portion of the nervous system, then with the known and well-established results of *experimental irritation and action* of various portions of these nerves, and we have found that the analogy is sufficiently close to admit the legitimate inference that the symptoms and pathological lesions of typhoid and typhus fever are produced by a normal action in certain portions of this system of nerves. First, because no typhoid or typhus phenomenon ever occurs, except in regions supplied by this system; secondly, because the peculiar phenomena of these diseases occur in a more marked degree, in those parts most abundantly supplied from this source; and thirdly, because the nature of these symptoms are always found more purely and characteristically typhoid in those portions of the organism supplied exclusively by this kind of innervation. And farther, on the other hand, we are forced to admit the truth of these impressions, because we have hitherto had no theory or legitimate and consonant combination of theories, to our own mind, as competent to the full and rational explanation of *all* the phenomena of the disease as the one now offered.

PRACTICAL DEDUCTIONS.—Pathology is only valuable when it has a tendency to the prevention, amelioration, or cure of disease, and the results of our most successful labours in this department are but nugatory unless in them can be found a clue to a more rational and perfect management of the affections to which they refer.

If the views embodied in the foregoing treatise are correct, the following practical inferences must present themselves as legitimate, if not inevitable: First, that in the management of this class of fevers the strictest attention should be paid to the improvement of the tone of the nervous system; all depressing measures, or such as are calculated to exhaust the nervous energies, as depletion by purgation or otherwise, should be scrupulously avoided; and secondly, that in their place means of an opposite character should be invoked. Indeed, that treatment now most in favour, though but empirically\* applied, will be found on the admission of the above pathology the most rational, and to offer the best hope of success. We have reference to that treatment which is addressed almost exclusively to the nervous system, and has for its object the sustentation and elevation of its energies. Some of the means employed have been attended in their application with the most marked beneficial results. Among these, we would mention the plan of Dr. Percival, wherein the disease was treated by frequent profuse cold affusions, especially in the case of children; which treatment we should rationally expect, from the known effect of cold water thus applied, to improve the condition of the depressed nervous centres. The administration of stimulants, as camphor, quinia, brandy, opium, turpentine, and the ethers, have all been favourably known to the profession as remarkably efficient in these fevers.

In relation to the beneficial results recently obtained from large doses of quinia, by Dr. Dundas and others, we can readily appreciate what vast benefit may accrue from them, especially in cases where the cerebro-spinal system of nerves are extensively implicated, and where the disease is marked by regular obstinate paroxysms, for quinia, though it possesses, in our opinion, but little influence over the ganglionic system itself, still, would relieve these periodic exacerbations by its effects upon this system, through the cerebro-spinal nerves (which in these cases we regard as the instigator of the paroxysm), upon which most of its power is expended. That the doses required should be large, we can easily understand, as any

\* Of course, this term is not applied in its offensive sense.



effect produced upon the ganglionic system through the cerebro-spinal is only accomplished by powerful and long-continued impressions, on account of the comparative isolation of the two systems from each other.

To those who are in the proper field for such experiments, and possessed of the proper facilities, we would recommend the trial, in typhoid and typhus fevers, of such agents as are known to possess a direct power to stimulate the nervous system, even when in a state of partial paralysis—such an agent is *strychnia*. This we would suggest as applicable in minute but efficient doses, with the view of waking up and restoring the diminished energy of innervation, upon which the impaired function depends, in the same manner that we would advise it in other similar cases where the cerebro-spinal system was implicated.

The above is all we offer in regard to treatment; there are many measures of a like nature, which, were we writing a complete treatise on the *management* of these diseases, would require a full and extended consideration, as also the measures and applications which the emergency of each case will naturally suggest and demand.

H. F. CAMPBELL,  
C. T. QUINTARD,  
ROBERT CAMPBELL,  
*Committee.*

138  
AN INQUIRY

INTO THE

NATURE OF TYPHOIDAL FEVERS.

BASED UPON A CONSIDERATION OF

THEIR HISTORY AND PATHOLOGY.

BY

HENRY F. CAMPBELL, M. D.

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PRESENTED TO THE AMERICAN MEDICAL ASSOCIATION,  
AT ITS SESSION OF MAY, 1853.

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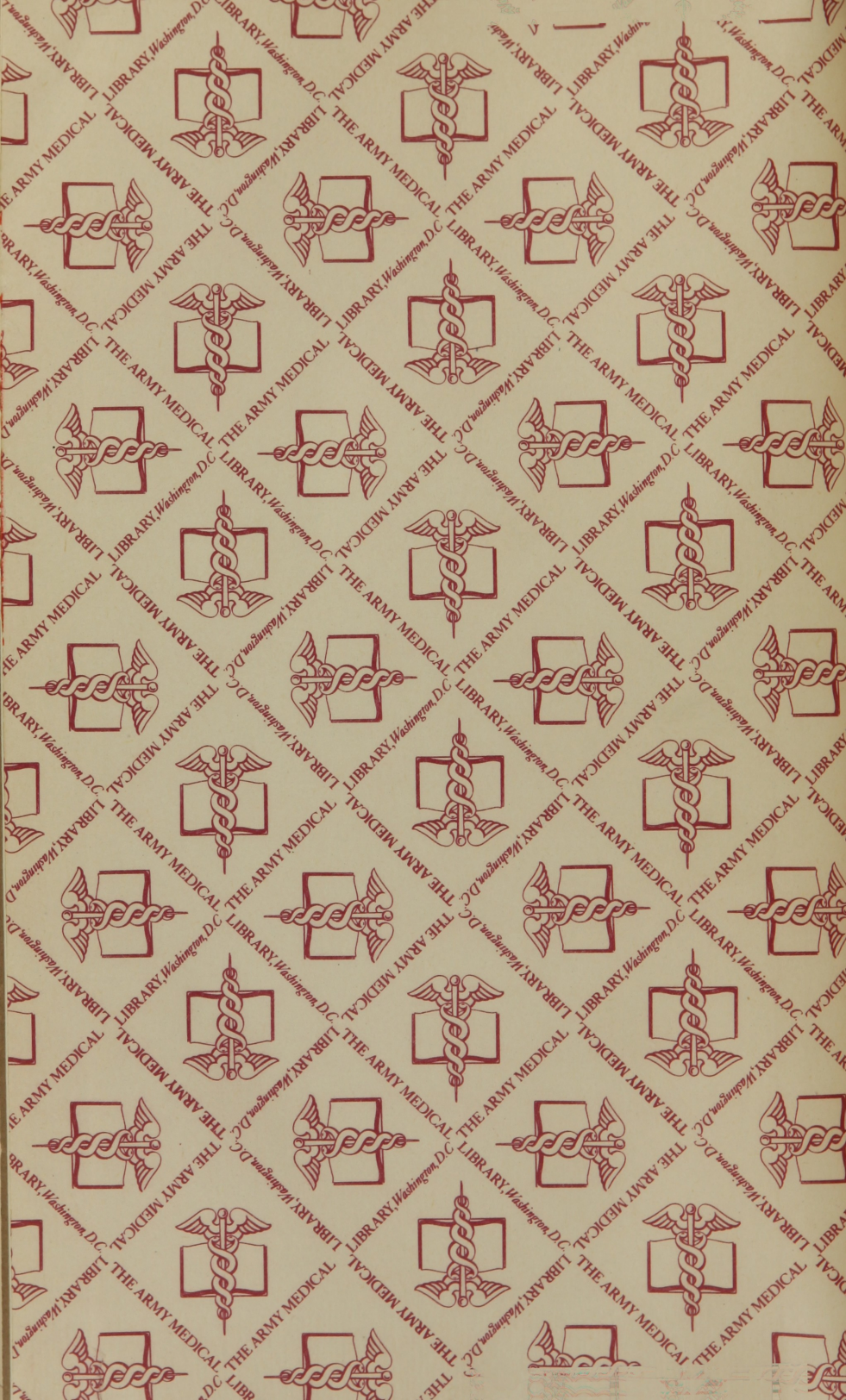
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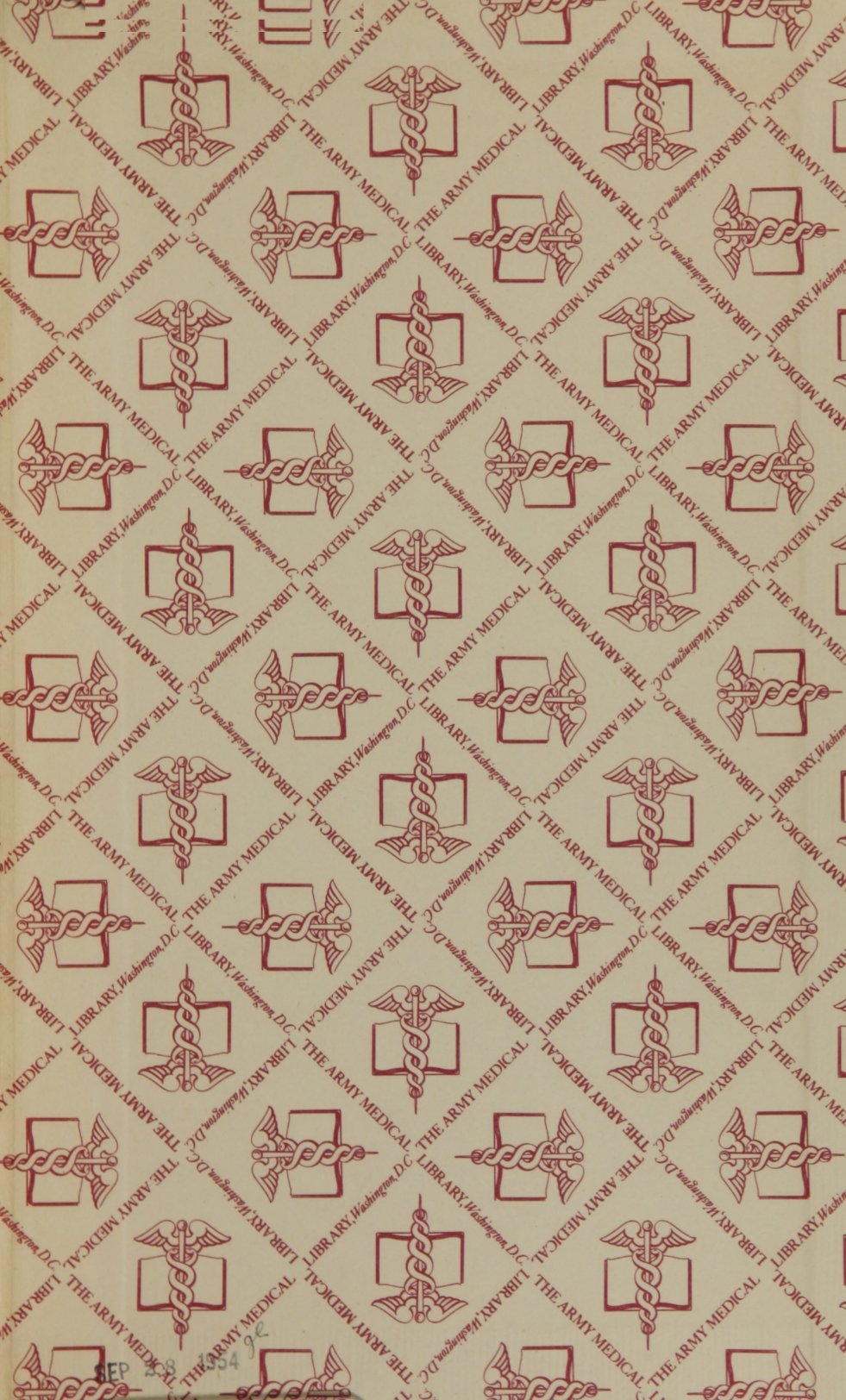














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